In the Supreme Court

OF THE

United States

OCTOBER TERM, 197

No. 76-1425

MAURICE A. GARBELL, INC.,
and
GARBELL RESEARCH FOUNDATION
Petitioners,
v.
THE BOEING COMPANY,
Respondent.

and

MAURICE A. GARBELL, INC.,
and
GARBELL RESEARCH FOUNDATION
Petitioners,
v.
McDONNELL–DOUGLAS CORPORATION,
Respondent.

PETITION FOR WRIT OF CERTIORARI
to the United States Court of Appeals
for the Ninth Circuit

APPENDICES A, B, AND C
"OPINIONS BELOW"

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March 22, 1977.

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APPENDIX A

MEMORANDUM DECISION, FINDINGS OF FACT,
CONCLUSIONS OF LAW AND
ORDER FOR JUDGMENT

Federal Supplement, Volume 385, Pages 1 through 57.

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*

MAURICE A. GARBELL, INC., et al.,
Plaintiffs,

v.

The BOEING COMPANY, Defendant.

MAURICE A. GARBELL, INC., et al.,
Plaintiffs,

v.

McDONNELL DOUGLAS CORPORATION, Defendant.

Civ. A. Nos. 63-658-AAH, 63-659-AAH.

United States District Court, C.D. California.

Oct 1, 1973.

Actions were brought for infringement of patent No. 2,441,758 which related to design and construction of a fluid-foil lifting surface and was directed to shape of aircraft wings. The District Court, Hauk, J., held that claims 1, 2, 3 and 7 were invalid because of lack of novelty and utility, because purported invention was anticipated, because subject matter was obvious to one skilled in art at time of alleged invention, and because teachings were insufficient and claims were ambiguous, and that contined prosecution of actions through trial in bad faith made case an exceptional one warranting award of attorneys' fees.

Judgment accordingly.

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Morris Lowenthal and George B. White, San Francisco, Cal., for plaintiffs.

Hahn, Cazier, Hoegh & Leff, Richard B. Hoegh and Russell P. Kuhn, Los Angeles, Cal., for defendants.

MEMORANDUM DECISION FINDINGS OF FACT, CONCLUSIONS OF LAW AND ORDER FOR JUDGMENT

HAUK, District Judge.

PRELIMINARY FINDINGS AND MEMORANDUM DECISION.

On June 6, 1963, some two and one-half years after Dr. Garbell became convinced that the Boeing 707 and the Douglas DC-8, on each of which he had taken one flight as a passenger, must incorporate his wing design since each exhibited such excellent flying qualities, the Garbell plaintiffs filed these actions against the defendants Boeing and Douglas.

The cases were assigned to Judge Peirson Hall who, on his own motion, dismissed each with prejudice. Subsequently, on plaintiffs' application, Judge Hall permitted amended complaints to be filed. Defendants' answers asserted non-infringement of the patent, invalidity of the patent and laches.

Discovery was initiated by the Garbell plaintiffs in the form of interrogatories directed to both defendants. The defendant Boeing moved to dismiss for want of venue and this motion was denied. Thereafter both defendants noticed the deposition of Dr. Garbell, the patentee and president of plaintiff corporations. At that early stage of the cases, the Court was given an indication of the discovery problems which would later ensue when the plaintiffs moved to prevent the taking of Dr. Garbell's deposition.

In 1964, the cases were transferred to Judge Francis Whelan who had been newly appointed.

The cases had been started with plaintiffs being represented by Wallace & Parker, Charles Parker, Esq. and Ronald Rattner, Esq. of San Francisco. On the motion of plaintiffs, Wallace & Parker and Charles Parker, Esq. were substituted out and the plaintiffs' new lawyers were Morris Lowenthal, Esq. and Jerome Field, Esq. of the firm of Lowenthal & Lowenthal, and Ronald Rattner, Esq. of San Francisco.

Defendants were represented by the firm of Older, Cazier, Preston & Hoegh (now Hahn, Cazier, Hoegh & Leff) and Richard B. Hoegh, Esq. of that firm in Los Angeles. In addition to Mr. Hoegh's firm, defendant Boeing was represented by J. Paul Coie, Esq. of Seattle, Washington, and defendant Douglas was represented by Walter J. Jason, Esq. of Los Angeles.

The first affirmative action taken by the plaintiffs' new lawyers (Messrs. Lowenthal, Field and Rattner) was to move to stop further discovery on behalf of the defendants for a period of several months. In the meantime, the plaintiffs had begun document inspection at the Long Beach plant of the defendant Douglas.

These cases were transferred to Judge Irving Hill in 1965. The defendant Boeing filed a motion to transfer the action against it to Seattle, which motion was denied by the Court.

Both defendants then moved to have a Special Master appointed to supervise discovery in these actions. At that time the docket entries in the Boeing action alone filled five pages of the Court's docket book. The Court granted the motion stating:

> "The Court, being duly advised in the premises, finds than an exceptional condition exists requiring that discovery be had under the supervision of a special master."

On September 27, 1965, the Order re Appointment of a Special Master was signed and Robert Henigson, Esq. of the law firm of Lawler, Felix and Hall in Los Angeles was appointed to supervise all pending and future discovery. The plaintiffs moved to vacate this Order and their motion was denied on November 22, 1965. Plaintiffs then moved for leave to file Petition for Writ of Mandamus in the Ninth Circuit asserting, among other things, the bias of Mr. Henigson. The motion was denied by the Ninth Circuit and the discovery matters were from that time presented to Mr. Henigson. The discovery matters presented to Mr. Henigson for schedul-

ing or determination filled practically fourteen pages of the Court's docket.

On August 1, 1966, these cases were transferred to Judge A. Andrew Hauk.

In October 1966, defendant Boeing filed a motion for an early and separate trial on the issue of infringement. The Garbell plaintiffs vigorously opposed Boeing's motion.

On January 20, 1969, the cases were set for trial in May of the following year. The parties were given until November 1, 1969, in which to complete all discovery in both cases, including document inspection on the DC-9 aircraft at the Douglas Long Beach plant and document inspection at the Boeing plant in Seattle. With respect to the Boeing discovery, apart from a request by letter made to Boeing's Seattle counsel for inspection of a few limited items, the plaintiffs had not intiated any document inspection at the Boeing plant and had not taken the depositions of any wing designers at Boeing in order to assess their infringement allegations against Boeing in the five and one-half years that the case had been pending. Indeed, the document inspection ordered by the Court on January 20, 1969, was done on the Court's own motion. /(Page 33 of the January 20, 1969 transcript)/.

On January 20, 1970, the parties were in Court on plaintiffs' motion to expand the reference to the Special Master to include the taking of evidence on all issues to be determined at trial. The Court expanded the order of reference to the Special Master to include the so-called geometry issues relating to the accused Boeing and Douglas aircraft and to the aircraft which defendants relied upon in support of any of their invalidity defenses.

Trial before the Special Master commenced on June 16, 1970, and lasted thirty days. The Special Master's report was filed December 31, 1970, and covers certain airfoils on the DC-8s and four prior art aircraft, the Curtiss-Wright Models 21B and 23, the Grumman F6F, and a German sailplane, the D-30 Cirrus. Other DC-8 airfoils and the remaining invalidity aircraft were to be

covered in a supplemental report by the Special Master. During the hearing before the Special Master, on cross-examination, plaintiffs, through Dr. Garbell, dropped their charge of infringement as to the DC-9 aircraft wing basing their decision to do so upon evidence supplied to them long before they subjected Douglas to a complete document inspection on the DC-9.

In mid-January, 1971, the plaintiffs filed two "motions for action" relating to the DC-8 findings in the Special Master's report and to the findings on the invalidity aircraft. These motions, in effect, were motions for partial summary judgment seeking a determination that the DC-8 wings infringed, based on the Special Master's findings and that the patent was valid over the prior airt aircraft. The motions were denied and, following a hearing on objections to the

Special Master's report, the report was modified by interlineation and filed.

On February 1, 1971, trial was scheduled to commence on June 1, 1971. Pretrial was set for May 3, 1971, and dicovery was opened up for an additional month. During the weeks before the trial, the plaintiffs filed several motions for continuance which were denied. The Special Master filed his Supplemental Report on May 5, 1971, and on May 14, 1971, plaintiffs moved to remand for further findings by the Special Master on the DC-8 airplane wing on the grounds Douglas had supplied erroneous data to plaintiffs in 1964. The plaintiffs claimed they were surprised by their own evidence presented to the Special Master and contained in the Supplemental Report. The Court granted the motion.

On June 1, 1971, a few minutes before the trial was scheduled to commence, the plaintiffs filed a motion for recusal of the trial judge on the grounds of bias and prejudice. The moving papers were considered and the motion denied. The parties spent the remainder of the Court time on June 1st attempting to settle the actions.

On June 2, 1971, trial of the actions commenced. The validity or invalidity of the patent was to be tried first, followed by Douglas infringement issues, to be followed by Special Master hearings on Boeing wing geometry and Court trial on Boeing infringement issues.

The plaintiffs put their patent in evidence and, without availing themselves of the opportunity to present further evidence as to the invention, rested. The defendants called Dr. Garbell as their first witness under Rule 43.

On Friday, June 4, 1971, the plaintiffs filed a Petition for Writ of Mandamus seeking review of the denial of their motion for recusal of the trial judge and on June 9, 1971, the Ninth Circuit Court of Appeals stopped the trial pending determination of the Petition for Writ of Mandamus. On August 12, 1971, the Court heard the petition and denied it on the same day.

On September 20, 1971, at a status hearing, Mr. Lowenthal, who had represented the plaintiffs since 1965, stated that Mr. Jerome Field, who had been co-counsel with him, had removed himself from the case. A hearing was held on November 1, 1971, substituting Jerome Field and Ronald Rattner out of the case and granting each of the attorneys a lien on any recovery made by plaintiffs in these actions. Plaintiffs appealed from this order, which appeal is now pending in the Ninth Circuit.

On November 20, 1971, at a further hearing, Mr. Henigson was ordered to proceed with the remand requested by the plaintiffs and resumption of the trial was set for March 7, 1972.

On February 3, 1971, after obtaining a 58 day extension of time in which to file a Petition for Writ of Certiorari in in the United States Supreme Court to review the Ninth Circuit's ruling on the Petition for Writ of Mandamus, the plaintiffs filed the Petition for Writ of Certiorari together with an application for a stay of the trial pending determination of the application for a writ. The defendants filed their opposition to the stay

application in the Supreme Court on the same day and the stay was denied by Mr. Justice Douglas on February 14, 1972.

The Special Master had set the trial of issues raised by the remand for February 7, 1972. The circumstances surrounding the setting of the trial date were described by Mr. Henigson in his order to show cause as to why the remand should not be dissolved on the grounds of lack of communcation and cooperation from the plaintiffs in the following language:

> "IT IS HEREBY ORDERED that the parties show cause before the Special Master, if any they have, on Monday, March 6, 1972, at 10:00 a.m. at Room 800, Standard Oil Building, 605 West Olympic Boulevard, Los Angeles, California, why he Special Master

> should not submit his final report to the above entitled Court without holding an evidentiary hearing to resolve the factual issues in dispute and without making the findings of fact contemplated by the May 24, 1971 order, for the reasons that all efforts directed to that end are frustrated by plaintiffs and that there is no reasonable prospect that the work can be accomplished in the foreseeable future."

Leading up to the Order to Show Cause, the Special Master observed in Letter No. 95, dated November 18, 1971:

> "I concede also that I think the difficulty imposed upon any attorney or firm required to stand by indefinitely but always at the ready, pending plaintiffs' obtaining trial counsel they think adequate to the task, is utterly intolerable."

In his Letter No. 100, the Special Master stated:

> "I cannot refrain from observing that the delays incurred in bringing this phase of the litigation to a close have been intolerable and are in large part attributable to unwarranted demands that counsel and Dr. Garbell be convenienced in the prosecution of the litigation which plaintiffs commenced." Dated December 30, 1971.

On February 1, 1972, the Special Master reported to the Court in Letter No. 102 the following:

> ". . . We have the astounding situation in which: plaintiffs desire to defer indeterminately any hearing pertaining to the geometry issues which, by their motion and the Court's order, were made a matter of reference to me as Special Master; and, defendants are anxious to have the matter heard and determined at the earliest possible time. My own view of the matter is that plaintiffs' counsel are entirely competent to represent plaintiffs in the action, that there are not serious prospects as (if, indeed, there are any serious endeavors to obtain) substitute counsel for plaintiffs and that, if plaintiffs' counsel have the time and energy to generate the copious paperwork recently filed with the respective clerks of the district court, the court of appeals and the Supreme Court, they can find the time and energy to attend a short hearing before me. Further, as you know, there is outstanding a Court order requiring that we proceed with deliberate speed in the completion of the work remaining to be done under my May 24, 1971 order. While "deliberate speed" has been variously construed, I do not think deferral of the hearing for an indeterminate period of time could possibly fit within any permissibly stretched meaning of the term."

At one Court appearance relating to the Special Master's proceeding, the plaintiffs were represented by Mr. John R. Jacobson from the Lowenthal & Lowenthal firm and on the day the Order to Show Cause was scheduled to be heard by the Special Master, March 6, 1972, plaintiffs were represented by Mr. George White, who appeared, but was not prepared to proceed and was not accompanied by Dr. Garbell or any other witnesses.

On March 7, 1972, trial re-commenced and in due course the Supreme Court denied the Petition for Writ of Certiorari. The Court observes that the actions of the plaintiffs in January and February required the defendants to prepare for trial on March 7, 1972, when the defendants could reasonably expect that plaintiffs would apply for a stay of the trial pending determination of their Petition for Writ of Certiorari and, at the same

time they were preparing for trial before the District Court, defendants would be required to prepare an opposition to the Petition for Certiorari. At the same time, defendants were required to prepared for a hearing before the Special Master scheduled to last several days commencing February 7, 1972, for a hearing requested by the plaintiffs in May of 1971, while the plaintiffs had no intention of showing up ready to proceed on the scheduled date.

The trial on the validity issues took 23 Court days and concluded June 2, 1972. Broadly, the defendants contended that the patent was invalid as being not "new or useful" under 35 U.S.C. sec. 101, that the purported invention was anticipated under 35 U.S.C. sec. 102, that the subject matter of the patent was obvious under 35 U.S.C. sec. 103, and that the teachings of the patent were insufficient and the claims ambiguous under 35 U.S.C. sec. 112.

The patent in suit entitled "Fluid-Foil Lifting Surface", No. 2,441,758, names Maurice A. Garbell as the inventor. The application for the patent was filed July 16, 1946, and the patent issued on May 18, 1948.

The patent has been assigned to two corporations, Maurice A. Garbell, Inc. and Garbell Research Foundation, whose major asset is the patent.

Airplane wings are "lifting surfaces"; and in this action the accused devices are the wings of jet transports manufactured by the two defendants, Boeing and Douglas, later McDonnell Douglas.

The principal object of the patent in suit is to design and construct a wing which causes the initiation of stall to occur at or near the mid-semispan of the wing, and to spread inboardly more quickly than outboardly. This object and the patentee's solution are not new.

The patent utilizes what Dr. Garbell, on occasion, called the tri-section wing principle in order to obtain a wing which would not exhibit the dangerous stalling characteristics attributed by Dr. Garbell to the prior art aircraft.

In the prior art aircraft construction it was customary for wing designers to choose a cross-section, or airfoil section, shaped for the wing tip and to choose another cross-section, or airfoil section, shaped for the wing root. The root section was typically located at the side of the body where the wing is attached to the fuselage or at the center line of the airplane where the two ends of the airplane wing were bolted together. The wing surface between the wing tip and wing root were then generated by a technique known as straight-line fairing betwen the wing root and the wing tip. The technique was similar to that of rolling up a piece of paper to form a cone with the tip section being thought of as the small end of the cone and the root section being thought of as the large end of the cone.

The claims of the patent here in issue, Claims 1, 2, 3 and 7, utilized a third or interjacent section along the wing semispan. This third section is different from that which would be found in the wing at the wing station chosen for the interjacent section if the wing were generated by straight-line fairing between the root and tip sections.

A tri-section wing shape is generated by drawing straight-line elements or allowing the straight-line fairing technique between the wing root and the interjacent section forming what is called the inboard panel, and by utilizing the straight-line fairing technique between the interjacent and tip sections to define the shape of what is called the outer panel of the wing. As many panels as the designer desires may be generated in this way between the wing root and the wing tip to form the entire wing surface.

In the claims of the patent, the airfoil sections for these various stations, the root, the tip and any interjacent section, is defined solely by what is called in the claims "mean line camber". In the claims here in issue, the mean line camber of the interjacent section must be greater than that which would be found in the old two-section wing generated by straight-line fairing between the root and the tip. The mean line camber of the root

section must be smallest in value, and the mean line camber of the tip section must be the greatest in value.

Other claims of the patent not here in issue, cover wings in which the camber of the interjacent section is less than that obtained by straight-line fairing between the root and the tip sections.

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In another patent obtained by Dr. Garbell, the camber of the interjacent section is greater than that at the tip section.

The combined coverage of the two patents thus encompasses all wings except those which Dr. Garbell conceded to be old.

In 1925, an inventor by the name of Cronstedt obtained a patent on a wing shape. His wing was defined by a tip section and a root section. The tip sections had the greatest camber, as is the case in the claims of the patent here in suit, and the root section had the least camber, as is also the case in the claims of the patent here in suit. The Cronstedt patent drawing depicted an interjacent section, but did not disclose whether the interjacent section in the drawing was that which you would find in a wing by straight-line fairing between the root and the tip sections, or something different. If it were something different, it would be covered by on of the claims of Dr. Garbell's patent. Whether Mr. Cronstedt knew more than he understood about the use of an interjacent section in that early wing is a matter of conjecture.

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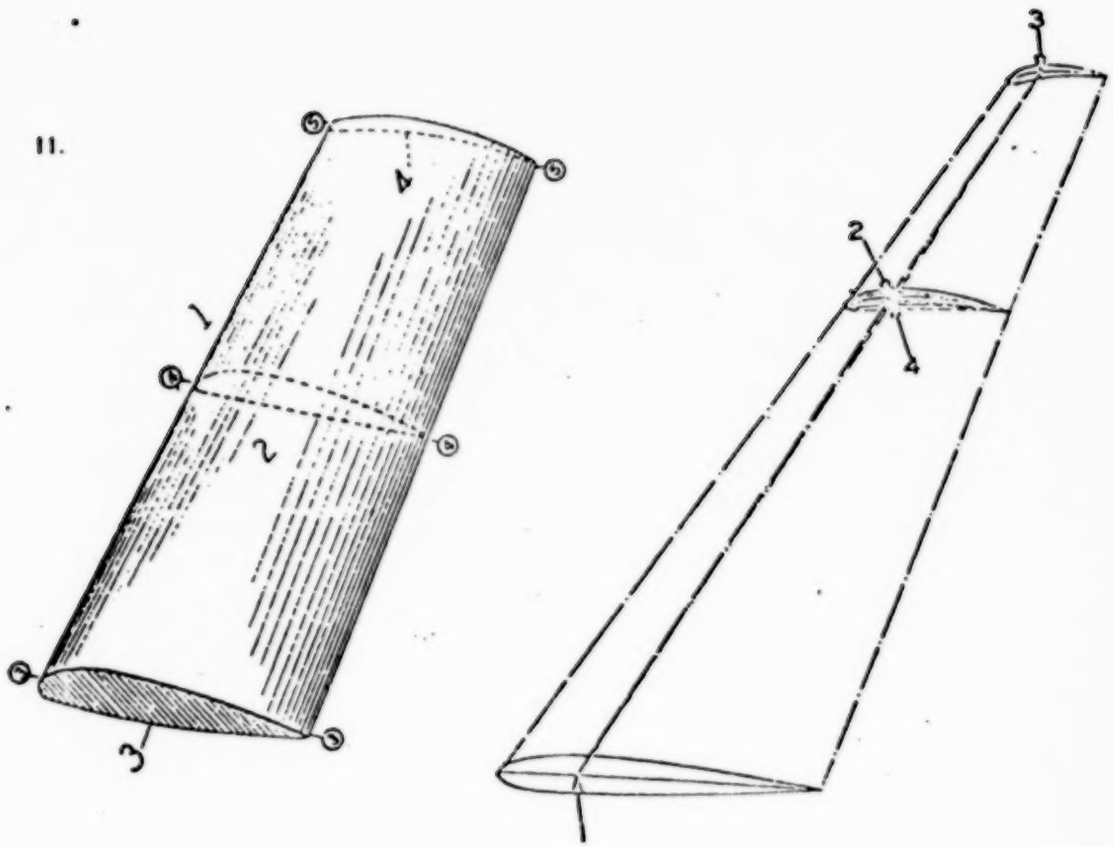

Inventor
VALDEMAR CRONSTEDT.
By Edmund A. Reed
Attorney

Maurice A. Garbell INVENTOR
BY Hayward & Thurgood
ATTORNEYS

July 28, 1925.

May 18, 1948.

Dr. Garbell's claims are an obvious variation of what is shown in Cronstedt.

By 1929 the National Advisory Committee on Aerodynamics (the NACA)

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set about systematizing the properties of airfoil sections and the relationship of camber and other parameters affecting the shape of the airfoil and relating such parameters to lift and drag. The earliest of such work systematizing data for the sections developed by the NACA was published in a Technical Report No. 460 in the early '30s. Professor Pinkerton, who appeared in this action as an expert on behalf of the defendants, was directly involved in the experimental and analytical work as an employee of the NACA. The work was undertaken to give aircraft designers a knowledgeable basis for deriving wing shapes so that lift and drag of the aircraft could be predicted with some accuracy. This and other publications of the NACA were distributed throughout the world and were available to Maurice Garbell when he was a student in Milan and working with others in designing the Pinguino sailplane.

Later studies of the NACA undertaken in the '30s utilized NACA sections in the construction of complete wings which were tested or in study wings approximating the planform of wings found in production airplanes which at the time did not have swept-back wings. One such wing had six interjacent sections which compares with Dr. Garbell's claims covering wings with one or more interjacent sections.

NACA continued its development and publication of airfoil data on through World War II with the publication of NACA Technical Report No. 824 co-authored by Mr. Ira H. Abbott, who appeared as one of the witnesses for the defendants in this action.

Independent researches were also studying the effects of airfoil parameters, such as mean line camber, in order to avoid tip stall on tapered monoplane wings being designed in the '30s and early '40s; e.g. Dr. Lombard, Exhibit BC.

All of these NACA publications included the relationship of the lift across the span of the wing to the maximum lift which could theoretically be generated at each station across the wing, similar to that shown in Figure 2 of the patent and called for by Claims 2, 3 and 7 of the claims in issue in this action.

As to whether or not the published NACA work made the subject matter of the patent in suit obvious, Professor Pinkerton said: "I can't read anything in the patent beyond what we knew and practiced in the '30s". /(T.R. 1021)/

In his work and in his published materials in evidence, Dr. Garbell utilized NACA airfoil sections and referenced NACA reports.

Dr. Garbell was employed at Consolidated Vultee in San Diego during World War II. There he worked on a tailless aircraft designed and proposed at least as early as 1944 using in it the wing configuration he later patented. Dr. Garbell gave a description of such wing without restriction to NACA which in turn distributed it to its various research facilities in early 1944.

About the same time, Dr. Garbell personally went to see Captain Diehl of the Navy in an attempt to sell the aircraft to the Navy on CVAC's behalf.

Dr. Garbell, while at CVAC and prior to July, 1945, also assisted in preparation of the proposal to the government for the sale of XB-46 aircraft. The proposal included a wing design covered by certain claims of the patent. Before July, 1945, Dr. Garbell was at the NACA wind tunnel at Ames, in California, in connection with wind tunnel work on the XB-46 CVAC had sold the government. The model incorporated a wing he had proposed and which was covered by claims of the patent.

Also while at CVAC and before the critical date of July 16, 1945, Dr. Garbell submitted his manuscript for a paper to be published by the Institute of the Aeronautical Sciences. The manuscript was seen by a great many people in the aircraft industry and in educational institutions. Dr. Garbell regarded the manuscript as a disclosure of the inven-

tion on which he subsequently obtained the patent at issue in this action.

More than a year after Dr. Garbell engaged in the foregoing selling activities and submission of his manuscript for publication, he applied for the patent in suit.

From the record it appears that Dr. Garbell took the prior art he was familiar with and proceeded to claim everything except that which he conceded to be old in an attempt to exact tribute from the aircraft industry. Using real property as an analogy, the metes and bounds of what he staked out in his two patents in effect claim everything on both sides of the river.

These considerations and others which appear in more detail in the Findings lead to the decision that the patent in suit is invalid for the reasons advanced by the defendants.

The Court adopts the foregoing preliminary statements as part of its Findings of Fact and makes additional Findings of Fact as follows:

FINDINGS OF FACT

A. GENERAL FINDINGS - THE PARTIES AND HISTORY OF THE SUIT

A1. Plaintiff Maurice A. Garbell, Inc. is a California corporation having its principal place of business at 1714 Lake Street, San Francisco, California.

A2. Plaintiff Garbell Research Foundation is a California non-profit corporation having its principal place of business at 1714 Lake Street, San Francisco, California.

A3. The president of the plaintiff corporations, Dr. Maurice A. Garbell, is the patentee.

A4. The patent in suit, No. 2,441,758,[1] is entitled "Fluid Foil Lifting Surface". The patent application which issued as the subject patent was filed on July 16, 1946, and assigned to Maurice A. Garbell, Inc. on April 15, 1948. Said patent issued on May 18, 1948, to Maurice Adolph Garbell, assignor to Maurice A. Garbell, Inc. An undivided three-fourths (3/4ths) part of the entire right, title and interest in said patent was assigned to the Garbell Research Foundation on September 15, 1949.

A5. Defendant The Boeing Company is a Delaware corporation having a regular and established place of business at 5822 Avion Drive, Los Angeles, California.

A6. Defendant Douglas Aircraft Company, Inc. was a Delaware corporation having a regular and established place of business at 3000 Ocean Park Boulevard, Santa Monica, California. Defendant Douglas was merged with and into McDonnell Company on April 28, 1967. As of that date, McDonnell Company's corporate name was changed to McDonnell Douglas Corporation. McDonnell Douglas Corporation is a Maryland corporation and has a regular and established place of business at 3000 Ocean Park Boulevard, Santa Monica, California.

A7. The complaints in these two consolidated actions were filed in 1963 by the plaintiffs for infringement of their patent No. 2,441,758 by the defendants The Boeing Company and Douglas Aircraft Company, later McDonnell Douglas Corporation.

A8. This action arises under the Patent Laws of the United States, 35 U.S.C. Sections 271,[2] 281,[3] and 28 U.S.C. Sec-

tion 1338.[4] The jurisdiction and venue of this Court was determined by the fact that each of the defendants has a regular and established place of business within this District and their activities charged by plaintiffs to be infringements of the patent in suit were carried out in this District and elsewhere.

A9. The patent in suit, No. 2,441,758, is entitled "Fluid Foil Lifting Surface" and is directed to the shape of aircraft wings. The accused devices manufactured by the defendant Boeing are the 707-320 B/C aircraft and the accused devices manufactured and sold by the defendant McDonnell Douglas are the DC-8 series aircraft. The claims of the patent at issue are Claims 1,[4a] 2,[4a] 3[4a] and 7.[4a] Plaintiffs allege that each of such claims is infringed by each of the defendants. The defense of invalidity is the only issue per the Amended Pretrial Conference Order, dated May 27, 1971.[5] In that connection, defendants allege and have shown to the satisfaction of the Court that the patent and each of said Claims 1, 2, 3 and 7 are invalid because they do not meet the absolutely essential tests of validity: 35 U.S.C. 101,[6] Novelty and Utility; 35 U.S.C. 102,[7] No

Prior Use or Sale and No Prior Publication; 35 U.S.C. 103,[8] Non-Obviousness; and 35 U.S.C. 112,[9] Definiteness.

A10. The patent was previously litigated in this District in an action by plaintiffs against Consolidated-Vultee Aircraft Corporation (CVAC), Civil Action No. 10930-Y. At the conclusion of the four day trial in that action, this Court, by Judge Yankwich, found the patent to be valid and infringed by CVAC and denied the defendants' claim of a shop-right. 94 F.Supp. 843 (S.D. Cal. 1950). The Ninth Circuit Court of Appeals, 204 F.2d 946 (9th Cir. 1953), found that the defendant had established a shop-right and declined to rule on whether the patent, or what it referred to throughout its opinion as the "alleged invention" was valid or infringed. Upon remand, Judge Yankwich dismissed the action with prejudice.

A-11. In the present action, on motion of defendants, a Special Master was appointed in 1965 to supervise discovery.

A12. Judge Hill's order appointing Mr. Robert Henigson to serve as Special Master was challenged as an abuse of discretion and Mr. Henigson was challenged for bias in plaintiffs' Petition for Writ of Mandamus filed in the Ninth Circuit Court. The Court denied the Petition.

A13. During the discovery proceedings, Mr. Henigson held approximately 37 meetings with counsel and attended numerous depositions to supervise the discovery proceedings.

A14. In April, 1970, plaintiffs asked to have Mr. Henigson appointed to hear all evidence in the case. The motion

was granted to the extent of the geometry relating to the accused Boeing and Douglas jet transport wings and wings relied upon by defendants in support of invalidity defenses.

A15 The Court reserved all remaining issues, including the issues of aerodynamics and interpretation of the patent, for trial by the Court.

A16. The trial before the Special Master commenced June 16, 1970, and lasted for thirty days. Eighteen witnesses testified and approximately 700 exhibits were received into evidence.

A17. The Report of the Special Master was filed on December 31, 1970, and adopted by the Court.

A18. The Special Master filed his Supplemental Report on May 3, 1971. It was adopted by the Court.

A19. Plaintiffs moved to remand on the grounds that Douglas had supplied erroneous data. The Court granted this motion on May 24, 1971.

A20. After repeated unsuccessful attempts to get plaintiffs to attend a hearing on remand issues, Mr.

Henigson issued an order to show cause why remand should not be vacated and thereafter reported to the Court that the remand be vacated.

A21. In the spring of 1971, the plaintiffs filed repeated requests for a continuance of the trial.

A22. On June 1, 1971, the day scheduled for commencement of trial, plaintiffs filed a motion to disqualify Judge Hauk. This motion was denied and taking of testimony commenced on June 2, 1971.

A23. On June 4, 1971, the plaintiffs filed a Petition for Writ of Mandamus seeking review of the ruling on their motion. On June 9, 1971, pursuant to an order of the Court of Appeals, the trial was stopped pending determination of the petition.

A24. The petition was argued in the Court of Appeals on August 12, 1971, and denied the same day. Rehearing was denied on September 9, 1971.

A25. On November 1, 1971 the Trial Court rescheduled trial to commence March 7, 1972.

A26. Plaintiffs obtained a 58 day extension for a total of 148 days in which to file a Petition for Certiorari in the Supreme Court and approximately three weeks before trial, on February 3, 1972, filed their Petition for Certiorari on the recusal matter and concurrently filed in the Supreme Court a Petition for a Stay of the trial and on February 4, 1972, plaintiffs filed a like applicaion in the Ninth Circuit. Both were denied and trial recommenced on March 7, 1972.

A27. Trial extended 23 court days, including that which commenced June 1, 1971. The record comprises approximately 4,000 pages of reporter's transcript and 50 volumes of papers filed with the clerk in connection with these two cases.

A28. At trial, plaintiffs put the patent in evidence and thereupon rested their case in chief. Defendants

called Dr. Garbell, the patentee and president of the plaintiff corporations, under Rule 43 and the following witnesses:

Professor Robert N. Pinkerton: Former Research Physicist for National Advisory Committee for Aerodynamics (NACA), Author of NACA Reports; Professor Emeritus, North Carolina State University.

Wesley T. Butterworth: Employed by North American Aviation on the Apollo Space vehicle; former employee of Curtiss-Wright and designer of the wings of the Curtiss-Wright Model 21B and Model 23.

Ira H. Abbott: Former Director of Research and Advanced Technology, National Aeronautics and Space Administration (NASA), Author of NACA Reports, Co-author of "Theory of Wing Section".

Al Riedler: Former Chief of Aerodynamics, Convair San Diego, during de-

velopment of Convair 880 and 990 aircraft. Currently working for the City of San Diego.

Dr. Albert E. Lombard, Jr.: Ph.D. Aeronautics and Physics, Cal Tech, 1939; Former Director of Research and Staff Vice-President, McDonnell Douglas Corporation.

William T. Hamilton: Formerly with NACA, now employed by The Boeing Company; was Director of Technology on the SST.

Orville Dunn: Director of Aerodynamics, McDonnell Douglas Corporation.

A29. Plaintiffs' rebuttal comprised the testimony under Rule 43 of Mr. Glenn Orlob, Patent Administrator of The Boeing Company and Mr. Walter J. Jason, Patent Director of McDonnell Douglas Corporation, and the testimony of the following:

Dr. William Bailey Oswald: Ph.D. in Aeronautical Engineering, Cal Tech. Former Chief of Aerodynamics, Douglas Aircraft Company; Santa Monica Division.

Dr. Maurice A. Garbell: The patentee and president of plaintiff corporations.

A30. The parties jointly designated portions of the depositions of the following named witnesses. The designated portions were read in open court by the trial judge.

William E. Nickey: Was a test pilot for Curtiss-Wright. Flew Curtiss-Wright Models 21B and 23.

Charles W. Harper: Deputy Associate Administrator for Aeronautics, Office of Advanced Research and Technology, NASA.

Max Munk: Formerly with the NACA.

Theodore Theodorsen: Consultant in Aerodynamics.

James G. McHugh: Senior Staff Engineer, Dynasciences Corporation. Formerly with NACA and NASA.

James C. Sivells: Staff Engineer at the Aerodynamics Division of the Von Karman Gas Dynamics Facility, ARO, Incorporated.

Loren Facka: Supervisor of Financial Accounting, Convair Division of General Dynamics Corporation.

Orville Dunn: Director of Aerodynamics, McDonnell Douglas Corporation.

Harold F. Kleckner: Aerodynamicist and wing designer, McDonnell Douglas Corporation.

Harold T. Luskin: Former Douglas aerodynamicist, and with Lockheed Missiles and Space Company. Now deceased.

Thomas Neill: Chief of Technical Publications Branch of the Office of Advanced Research and Technology, NASA.

Hartley A. Soule: Formerly with NACA, author of several NACA reports.

B. DEFINITION OF TERMS USED IN THE PATENT.

B1. The patent in suit, United States Letters Patent No. 2,441,758, relates to the design and construction of a fluid-foil lifting surface. The term "fluid-foil lifting surface" is synonymous with "wing", "fin" or "blade", which produces lift when moving through a fluid such as air or water.

B2. The term "fluid-foil section" is synonymous in the art of aerodynamics with the term "airfoil section", and typically represents a cross-section of a wing.

B3. A controlled fluid-foil section is one which has been pre-selected by the designer to form a cross-section of the wing at a given station.

B4. The term "at the root", as used in the patent, and as interpreted according to standard industry practice at the time of the alleged invention, refers to the location at the plane of symmetry (longitudinal center-line) of the airplane, and possibly to a location at the wing-fuselage intersection. To the aero-

dynamicist, the term "root" most commonly refers to a location at the plane of symmetry. Figures 2 and 3 of the patent in suit indicate that the "root" (Figure 2) is synonymous with the "center line" (Figure 3).

B5. The surface of wings is usually formed by fairing between controlled sections, i.e. from the station located at the root to the one located at the tip or from root to interjacent section and from interjacent section to the tip section.

B6. Mean line camber is a property of the mean line of an airfoil section, i.e., a line lying midway between the top and bottom of an airfoil section measured perpendicular to the mean line.

B7. An airplane in flight is sustained in the air by lift forces generated by the flow of air past the surface of the wings of the airplane.

B8. The "stall" of an airplane refers to a phenomenon in which the airflow over the upper surface of the wing separates from the surface, or ceases to flow in a pattern approximately conforming to the upper surface of the wing. An airfoil performs ints normal function of generating lift most efficiently when the airflow over the foil is smooth rather than turbulent. The main flow remains "attached" to the surface of the foil. As the angle of attack increases, however, the airflow over the upper surface encounters difficulty in remaining smooth, "attached". A separation or stall occurs when the wing is forced to an angle of attack which is too high relative to the oncoming airflow.

B9. All wings will stall at some ascertainable angle of attack. The major factor which determines whether stall characteristics of an airfoil are acceptable is the degree to which the airplane is controllable during the stall.

B10. Stall or air separation causes the wings to lose their lift capability and as stall increases the airplane will eventually begin to drop. If, as a result of the initiation of stall, the airplane experiences a pitch-up moment, causing the angle of attack to increase even further, the pilot will necessarily have to exert a positive downward control moment, viz, by pushing the control column forward, in order to prevent a worsening of the stall condition. On the other hand, if the natural tendency of the airplane at the initiation of stall is to experience a pitch-down moment, the plane will tend to recover from the stall without attention by the pilot. Pilot control of pitch attitude at stall is an important stall characteristic.

B11. Another aspect of stall which is of importance to the designer, as well as the pilot, is the effect of the stall on the roll behavior of the airplane, which brackets the pilot's ability to control the plane's roll behavior.

Stall initiation on a typical wing usually means that only a portion of the wing has stalled, that only a portion of the wing has lost its lift. Loss of lift on a portion of the wing results in a redistribution of the forces operating on the wing and the airplane. If the respective areas of separation on the right wing and the left wing are not symmetrical, there is an imbalance of the forces which results in a roll moment or roll behavior of the airplane. Changes in net lift on the wings become more significant the further outboard on the wings they occur because greater roll moments are created as the location of the force imbalance moves away from the longitudinal centerline of the airplane. For this reason, it is generally considered desirable to avoid a wing design which results in initiation of stall at or near the wing tip.

B12. The principal object of the patent in suit is to design and construct a wing shape which causes the initiation of stall to occur at or near the mid-semispan of the wing, and to spread inboardly more quickly than outboardly. This object and the patentee's solution are not new since the desirability and technique of avoiding tip stall were

known and understood in the art long prior to the application date of the patent in suit.

B13. The maximum attainable section lift coefficient of an airfoil section, or its $C_{l_{max}}$, is a quality which was well appreciated in the art of aerodynamics prior to the date of the application which matured into the patent in suit. In theory, the lift coefficient of an airfoil section is directly proportional to the angle of attack of the section with respect to the oncoming airflow. As the angle of attack is increased, there is a proportional increase in the lift coefficient or lift capability of the airfoil section. As the angle of attack is continually increased, however, there will be no further corresponding increase in lift coefficient or lift capability. At this point, the section is said to have reached its maximum lift coefficient, or $C_{l_{max}}$. In fact, further increases in

angle of attack will result in decreases in lift capability. The physical phenomenon which begins to occur at the maximum lift coefficient is referred to as stall.

B14. The spanwise distribution of actually prevailing section lift coefficients, or C_l distribution, is also a term and quality well understood in the art of aerodynamics prior to the filing date of the application for the patent in suit. Theoretical approaches to determine the C_l distribution were advanced and published even before the Wright brothers' first flight.

B15. The relationship of the C_l and $C_{l_{max}}$ distributions set forth in the patent is reflected in Figure 2 of the patent, which is commonly referred to as a stall diagram.

B16. Stall diagrams, including the stall diagram of Figure 2 of the patent, and the methods for creating stall diagrams were well known in the prior art as early as the 1930's. For example, methods for creating stall diagrams were taught in NACA Technical Report 572 (Exhibit E, 1936). NACA Technical Report 703 (Exhibit I, 1940) and NACA Technical Note 713 (Exhibit J, 1939) were extensions of the work described in TR 572 and further showed the use of stall diagrams and the limitations in the theories underpinning such diagrams.

B17. The so-called envelope feature of Claim 2 declares a relationship between the $C_{l_{max}}$ and C_l distributions in the stall diagrams which relationship is, in fact, inherent in the creating of the stall diagram. In theory, the $C_{l_{max}}$ distribution always "envelopes" the C_l distribution because the the actually prevailing lift (lower curve in Figure 2 of the patent) at any given spanwise location can never exceed the maximum attainable lift (upper curve in Figure 2 of the patent) at the same spanwise location. Therefore, wherever the C_l at any point on the wing reaches its maximum as shown in

the $C_{l_{max}}$ distribution on the stall diagram, stall is said to initiate on the wing.

C. PRIOR ART KNOWN TO DR.GARBELL WHEN THE APPLICATION FOR PATENT WAS FILED.

C1. The patent application sought to utilize airfoil section data in a wing which, broadly speaking, was defined by three airfoil sections, one located at the root having the least mean line camber, one at the tip having the greatest camber, and an interjacent section having camber at variance with that obtained by straight-line fairing between root and tip. The wing was claimed to improve stall.

C2. At the trial Dr. Garbell conceded:

a) It was old in the art at the time of the alleged invention to use three or more controlled sections to define the exterior shape of an aircraft wing.

b) It was old in the art as of 1946 to select three or more (as many as eight) controlled airfoil sections to define the shape of a wing for aerodynamic purposes;

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c) It was old in the art to define the exterior shape of a wing using three or more controlled sections for the purpose of avoiding tip stall;

d) It was old in the art, prior to 1946, to obtain an increase in the $C_{l_{max}}$ of an airfoil section by increasing the camber of that same section for the purpose of avoiding tip stall;

e) It was old in the art to have a wing with the least camber at the root;

f) It was old in the art to have a wing with the greatest camber at the tip;

g) It was old in the art to compute the actually prevailing lift across the semispan in accordance with the teachings of the patent in suit;

h) It was old in the art to have an interjacent section that was different from the section obtainable by straight-line fairing between the root and tip sections:

i) It was old in the art to determine the spanwise distribution of maximum attainable section lift coefficients in accordance with the teachings of the patent in suit.

C3. In the early development of the art of aerodynamics and wing design, it was recognized that the airflow around three-dimensional bodies such as airplane wings is an extremely complicated phenomenon. Simplifying assumptions about the airflow were made so that some systematic theoretical research could be carried out.

C4. One of the first simplifying assumptions made was to substitute a two-dimensional airfoil section for the three-dimensional wing or fluid-foil surface. In the conception of the airfoil section, the section actually represents a cross-section profile or slice through a wing having the same section and dimensions throughout the span. The airfoil section, having only two dimensions, induces airflow in only two dimensions rather than in three dimensions.

C5. The concept of the airfoil section proved to be extremely useful for both theoretical and experimental research efforts. The aerodynamic properties of airfoil sections could be investigated in a "laboratory" setting, apart from how any given airfoil section might behave in an actual three-dimensional airplane wing. During the 1920s a great many airfoil section shapes were investigated in this country as well as in Europe, but the most expansive work was begun by the National Advisory Committee on Aeronautics (NACA) in the late 1920s.

C6. In 1931, the NACA published Technical Report 383 by Dr. Theodore Theodorsen (Exhibit N). In this

report, Dr. Theodorsen described the thin wing theory, a refinement to the theory of airfoil sections. The thin wing theory applies to the component of flow associated with the relative curvature or mean line camber of the section.

C7. NACA's approach to research on the behavior of airfoil sections was to develop families of related airfoil sections, to determine certain properties of those sections. Such work was done by Prof. Robert M. Pinkerton around 1929.

C8. The NACA set about testing two-dimensional models of these sections in their wind tunnel facilities. In 1935, the NACA published Technical Report 460 (Exhibit A) which presents the results of the development and testing of the NACA's first series of related airfoil sections, called the NACA four-digit airfoils.

C9. Research continued, and a five-digit series of airfoil sections was developed, followed by the six-digit series of airfoil sections. For the most part, the airfoil development work was unclassified, and the NACA published hundreds of pages of data in the form of technical reports and technical notes which were distributed throughout the world prior to July 1945.

C10. The NACA's objective in developing its airfoil sections and in publishing data on those sections was to provide the aircraft industry and wing designer with basic data which would enable wing designers to make knowledge-

able choices of airfoil sections for wing design. As evidence of the acceptance of the quality and quantity of the NACA's work, it is to be noted that Zien, writing his paper in Germany in 1938, used NACA airfoil sections in his example wing (Exhibit AP). Lachmann, writing for the Journal of the Royal Aeronautical Society in 1937, used NACA airfoil sections in his example (Exhibt AO). Zacher, in his article (Exhibit AJ) which describes the

development of the D-30 Cirrus Glider notes that NACA mean lines were designated for the root and tip sections of the D-30 Cirrus. Virtually all of Dr. Garbell's glider designs built in Italy in the 30's and all of Dr. Garbell's proposals and designs made while he was employed at CVAC featured NACA airfoil designations. It is undisputed, therefore, that the concept of the airfoil sections, the use and utility of airfoil sections and airfoil section data in wing design were commonly known and understood in the art well before the date of the application which matured into the patent in suit.

D. COVERAGE OF THE CLAIMS.

D1. Claim 1 of the patent in suit relates to a lifting surface defined solely by specifying the relative mean line camber values of the three or more controlled airfoil sections in the wing. The least mean line camber must be in the controlled section at the root, the greatest mean line camber must be in the controlled section at the tip, and the mean line camber values at one or more interjacent sections must be greater than which would be obtained at the same respective spanwise location of the interjacent sections by straight-line fairing between the root and tip airfoil sections.

D2. Claim 2 of the patent in suit also defines a wing solely in terms of the relative mean line camber values of the controlled fluid-foil sections making up the wing. However, Claim 2 contains further limitation that " . . . said three or more controlled fluid-foil sections having values of the mean line camber selected in such manner that the resulting spanwise distribution of maximum obatinable section lift coefficients of the three or more controlled sections forms a curvilinear polygon enveloping a curve representing the spanwise distribution of section lift coefficients for a given planform actually prevailing at the maximum attainable lift coefficient of the lifting surface".

There are three elements of the foregoing limitation; the spanwise distribution of maximum attainable section lift coefficients or $C_{l_{max}}$ distribution, the spanwise

distribution of actually prevailing section lift coefficients, the C_l distribution, and the envelopment feature.

D3. Claim 3 is essentially the same as Claim 2 with the addition of a further limitation, " . . . that the said resulting spanwise distribution of maximum attainable section lift coefficients for a given planform be so shaped that the first intersection with the spanwise distribution of actually prevailing section lift coefficients occurs in that interval of spanwise stations in which stall inception is to obtained". This "tangency" limitation, describes where stall will occur on the wing based on the relationship between the $C_{l_{max}}$ and C_l distributions.

D4.Claim 7 relates to a lifting surface defined according to the same mean line camber relationship set forth in Claim 1 i.e., smallest, greater, greatest going from root to tip with the addition of a limitation as to the location of at least one interjacent section, i.e., where two lines drawn tangent to the lift distribution, C_l, intersect.

D5. Other claims in the patent cover variants where the mean line camber of the interjacent section is less than that obtained by straight line fairing.

D6. The patent issued on the continuation-in-part application 2,498,262, extended the patentee's coverage to wings

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in which the camber of the interjacent section exceeded that at the tip.

REDUCTION TO PRACTICE.

E1. Neither the patentee, Dr. Garbell, nor the plaintiffs ever actually reduced to practice the alleged invention covered by Claims 1, 2, 3 and 7 of the patent in suit:

E2. Neither of the defendants, McDonnell Douglas and Boeing, designed, developed, constructed or performed work of any kind on wings on for or on behalf of Dr. Garbell, and none of the wings employed in anywise by the defendants are or were reductions to practice of the invention of the patent in suit.

E3. Dr. Garbell was never an employee of, nor performed any work for, either of the defendants, McDonnell Douglas and Boeing.

E4. No one acting for or on behalf of Dr. Garbell ever actually reduced to practice the alleged invention covered by the claims of the patent in suit.

E5. The tangible embodiments of the wings, which Dr. Garbell testified he designed for the CVAC Two-Engine Tailless , the XB-46, the Model 107, the Model 110 and the other CVAC airplanes, Models 240, 340, 440 and 880 having wings allegedly covered by the patent claims, cannot be relied upon by Dr. Garbell as actual reductions to practice for or on behalf of Dr. Garbell.

E6. Dr. Garbell was paid by CVAC, as its employee, for such design and other work as he may have performed in connection with the wings above named.

E7. CVAC manufactured all the above wings either for its own purposes or for purposes of the Government.

E8. CVAC was not the agent of Dr. Garbell as to any of its operations, and, more specifically, was not Dr. Garbell's agent as respects any wings it may have constructed which embodied a camber distribution covered by any of the claims of the patent in suit.

E9. Dr. Garbell "constructively" reduced his invention to practice by the filing of the application of the patent in suit on July 16, 1946. The earliest date plaintiffs can rely upon as the date of invention is thus July 16, 1946 for purposes of applying Section 102.

F. ANTICIPATION - THE CURTISS-WRIGHT DEVELOPMENT.

F1. In a period from approximately 1935 to 1940, the Curtiss-Wright Company, St. Louis Division, built series of single-engine, low-wing monoplanes. The first of these airplanes was known as the Curtiss-Wright 19L. As originally built, the Model 19L had a constant camber wing, that is the camber at the root was the same as the camber at the tip with no variation between root and tip. During flight tests, this wing proved to have very poor stall qualities, with a tendency to stall near the wing tips causing dangerous roll behavior. Dr. Albert E. Lombard, Jr. of the Curtiss-Wright Company modified the 19L wing in order to improve its stall characteristics. The modifications were carried out by adding a "glove" to envelope the leading edge area of the 19L wing. The glove had the effect of increasing the camber of the wing near the tip with the increase in camber diminishing proportionately in moving inboard from the wing tip to the Rib 4 station. In addition to increasing the camber, the glove had the effect of increasing the leading edge radius of the wing.

F2. The modified version of the Curtiss-Wright Model 19L became known as the Model 19R. Flight tests showed that the Model 19R wing was a substantial improvement over the 19L wing in terms of stall performance. Dr. Lombard disclosed his work to the public in an article entitled "Technological Improvements in the Curtiss-Wright Coupe", published in the Journal of the Aeronautical Sciences, June, 1936 (Exhibit BC).

F3. Dr. Albert E. Lombard, Jr.'s article illustrates the fact that it was well-known in the art prior to the filing date of the application with matured into the patent in suit that an increase

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in camber of a given airfoil section could bring about an increase in the maximum lift coefficient of the airfoil section and that the use of a highly cambered section in the tip region of an aircraft wing would help prevent tip

in camber of a given airfoil section could bring about an increase in the maximum lift coefficient of the airfoil section and that the use of a highly cambered section in the tip region of an aircraft wing would help prevent tip stall; that is, that the airfoil sections near the tip would not reach their maximum lift coefficient (stall point) at the same time that sections further inboard would begin to stall. This fundamental principle, that an increase in camber tends to increase the maximum lift coefficient of an airfoil section, has also been taught in the earlier publications of the NACA, particularly in Technical Report 460 (Exhibit A). Dr. Lombard's paper received wide attention as evidenced by the fact that it was subsequently cited by Zien in 1938 (Exhibit AP), written and published in Germany. Dr. Lombard paper is also cited by Lachmann (Exhibit AO), published in the British Journal of the Royal Aeronautical Society in 1937.

F4. In 1938, the Curtiss-Wright Company undertook to design a fighter aircraft to be entered in a Government competition. The engineering decision was made to adopt the outer wing panel of the old Model 19R configuration for what would become the outer panel of the wing of the new Model 23 airplane. Up until the design of the Model 23 airplane, Curtiss-Wright had been building its single-engine monoplanes with fixed landing gear or partially retracted landing gear. In order to give the Model 23 greater performance, it was determined that the Model 23 would have flush retracting landing gear.

F5. The Model 23 wing was designed to give improved aerodynamic performance as to both lift and drag.

F6. The wings of the Curtiss-Wright Model 21B and the Model 23 have the same geometry and are formed of three controlled airfoil sections.

F7. The Court has adopted the findings of the Special Master with respect to the Curtiss-Wright Model 21B and Model 23 as set forth on Page 41 of Exhibit 1 as follows:

Airfoil	Mean line shape	Semi-span position	c_{l_i}	Max. rise	Chordwise location of max. rise
Rib 1	Ex. IH-10A 246 and R.970	0.0%	.00	0.0%	-
Rib 4	Ex. KE-1	26.5%	.27	1.9%	30%
Rib 11	Ex.KE	92.9%	.48 to .54	3.5%	30 to 40%
*Faired airfoil	Ex. KE-2	26.5%	.079 to .085	0.6%	30%

*Straight line faired between the Rib 1 and Rib 11 stations at the Rib 4 station.

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F8. Rib 1 of the Curtiss-Wright Model 21B and Model 23 airplane wings is the controlled fluid foil section lacated at the root.

F9. Rib 4 of the Curtiss-Wright Model 21B and Model 23 airplane wings is the interjacent controlled fluid foil section.

F10. Rib 11 of the Curtiss-Wright Model 21B and Model 23 airplane wings is the controlled fluid foil section located at the fluid-dynamically effective tip.

F11. The Curtiss-Wright Model 21B and Model 23 wings were thus characterized by a camber distribution as called for by Claims 1, 2, 3 and 7 of the patent in suit in which the controlled airfoil section located at the root had the least mean line camber, the controlled airfoil section located at the tip had the greatest mean line camber, and in which the interjacent controlled airfoil section had a mean line camber at variance with, and greater than, the

mean line camber of the airfoil section obtainable at the same interjacent spanwise station by means of straight-line fairing between the airfoil section at the root and the airfoil section at the tip of the wing.

F12. Plaintiffs' own evidence supports precisely that wing geometry which defendants sought to prove and which the Special Master found for the Model 21B and Model 23 wings and shows the improvements in lift obtained by this wing over the previous wing used on the Model 19R.

F13. Stall analysis of the Curtiss-Wright Model 21B and Model 23 wing design (Exhibit IP) shows that the spanwise distribution of maximum attainable section lift coefficients of the three controlled sections forms the equivalent of a "curvilinear polygon" which envelopes the curve of the spanwise distribution of actually prevailing section lift coefficients near the maximum attainable lift coefficient of the lifting surface, as covered by Claims 2 and 3 of the patent in suit.

F14. The stall analysis for the Curtiss-Wright Model 21B and Model 23 wing design (Exhibit IP) shows that the first intersection of the curves of the maximum attainable and actually prevailing lift coefficients occurs in the vicinity of mid-semispan in accordance with the objectives of the patent in suit.

F15. The stall analysis for the Curtiss-Wright Model 21B and Model 23 wing design (Exhibit IP) shows that the wing design substantially achieves the object of the patent in suit in avoiding tip stall and in creating mid-semispan stall which spreads more rapidly inboard than outboard.

F16. Analysis of the design of the Curtiss-Wright Model 21B and Model 23 wing design (Exhibit IP-1) shows that the interjacent fluid foil section is located near a spanwise point corresponding to the intersection of a tangent to the inboard portion of the curve of actually prevailing section lift coefficient and a substantially horizontal tangent to the highest point of the same curve as covered by Claim 7 of the patent in suit.

F17. The Curtiss-Wright Model 21B and Model 23 wings embodied the same combination of elements as claimed in Claims 1, 2, 3 and 7. The Curtiss-Wright Model 21B and Model 23 wings performed the same functions and achieved the same objectives sought by the patent in suit.

F18. Flight tests of the Curtiss-Wright Model 21B and 23 airplanes showed that each of the respective airplanes had highly satisfactory stall characteristics.

F19. The Curtiss-Wright Model 23 airplane was built and offered for sale in the United States to the United States Government in 1939.

F20. The Curtiss-Wright Model 21B was manufactured and placed on sale in the United States in 1940.

F21. Aircraft of the Fighting Powers (Exhibit PK) states the following with reference to the Curtiss-Wright Model 21B:

> "The 21B was built solely for export and had never seen service on any battlefront when accepted by the Dutch. Nevertheless, when action was joined with the Japanese in the spring of 1942 the CW 21B proved to be the best fighter in service with the Netherlands East Indies and gave a fine account of itself. Its top speed was higher than that of either the Mohawks or the Buffaloes, and the climb was simply phenomenal."

F22. The Army Air Force evaluation of the Curtiss-Wright Model 21B (Exhibit BM-6) states:

> "Performance of the Curtiss-Wright CW-21B compares quite favorably with that of the Japanese Zero".

F23. The Curtiss-Wright Model 21B and Model 23 wing shape was utilized in

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later proposals, e.g. P-248 (Ex. JX-19); developed by Curtiss-Wright for new fighter aircraft.

G. ANTICIPATION AND OBVIOUSNESS - ZIEN, LACHMANN, LOMBARD, NACA and ZACHER.

G1. The essence of the alleged invention had been published and was widely known more than one year prior to the application for the patent in suit.

G2. An article by Zien published in Germany in 1938 (Exhibits AP and AP-1), described the use of a non-straight-line faired camber distribution in a wing for the dual purpose of reducing the wing induced drag and for bringing about safe stall characteristics.

G3. On the basis of the teachings of the Zien article, and the example wing given by Zien, it would be obvious to persons of ordinary skill in the art at the time of the alleged invention to choose non-straight-line faired camber distributions on which the claims in suit of the subsequent Garbell patent would read with the specific purpose of improving the stall characteristics of airplane wings and for preventing tip stall on airplane wings.

G4. The Zien paper shows an example wing having five controlled airfoil sections, one section being at the root, another section at the tip and three interjacent sections in which each of the three interjacent sections has a mean line camber greater than (and "at variance with") that which would be obtainable at the respective spanwise stations of the interjacent sections by straight-line fairing between the the root and tip sections. The Zien example differs from a wing covered by a literal reading of Claims 1, 2, 3 and 7 of the patent in suit only to the extent that the camber of the outermost interjacent section is equal to the camber of the tip section (i.e., a "constant camber outer panel").

G5. Although the specific example given by Zien has a constant camber outer panel which, according to a strict reading of the claims of the patent, would not be covered by the claims in suit, it is recognized that the example is nothing more than an illustration of the method of wing design proposed by Zien. Zien proposed

the use of non-straight-line faired camber distribution for the specific purpose, among others, of improving the stall characteristics as compared to a wing defined only by sections at the root and tip. It is concluded, therefore, that the subject matter of the patent is equivalent to the methodology taught by Zien in means, function, and result. Persons of ordinary skill in the art would recognize that the specific example offered by Zien does not represent the only camber distribution which would accomplish the objectives of the Zien methodology, and that Zien teaches, in substance, that many different types of camber distributions, including those covered by Claims 1, 2, 3 and 7 of the patent in suit, may be useful to accomplish those objectives.

G6. The Zien wing differs from the wing called for by a literal reading of Claims 1, 2, 3 and 7 of the patent in suit in that one of its interjacent sections, the outermost section has a mean line camber equal to the mean line camber of the tip section. It is apparent that if the tip section were removed, the Zien wing would have the precise camber relationship called out by Claims 1, 2, 3 and 7 of the patent in suit, and would be a workable wing.

G7. There would be no critical difference between the stall performance of the Zien example wing and a wing having the precise camber relationship called out by Claims 1, 2, 3 and 7 of the patent in suit.

G8. The Lachmann article published in 1937 (Exhibit O), taught the utility of non-straight-line faired camber distributions for the purpose of improving stall characteristics of wing designs. Lachmann teaches a distribution of cam-

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ber along the semispan of a wing to avoid tip stall.

G9. Lachmann disclosed an example wing in which the root section had the least mean line camber and the interjacent section had a camber equal to the camber of

the tip section, the camber of both interjacent and tip sections are greater than that of the root section.

G10. There is no critical difference between the geometry of the example wing given by Lachmann and the geometry of the wings covered by Claims 1, 2, 3 and 7 of the patent in suit.

G11. Camber distribution covered by Claims 1, 2, 3 and 7 of the patent in suit is created from the Lachmann example with a slight decrease in the camber of the interjacent section.

G12. Lachmann taught that, in general, improvements in stall characteristics of tapered wings could be accomplished by using non-straight-line faired camber distributions. The specific example given by Lachmann, although not precisely covered by the claims of the patent in suit due to the constant camber outer panel of the Lachmann wing, nevertheless was demonstrated analytically to have satisfactory stall characteristics.

G13. In view of the teachings of the Lachmann article, the subject matter of the patent in suit would have been obvious to those of ordinary skill in the art at the time of the alleged invention and long prior to the filing date of the patent.

G14. It is concluded that the subject matter of the patent in suit is equivalent to the methodology taught by Lachmann in means, function and result.

G15. Dr. Garbell, while an employee of CVAC, prepared Aero Memo #604 dated March 2, 1945, (Exhibit KK) which proposed to CVAC the use of an alternate wing to correct the unfavorable stalling characteristics of the wing of the XB-36 airplane.

G16. Aero Memo #604 (Exhibit KK) contains the statement, "The 'tri-section wing' principle which has been successfully applied to the Tailless design, the executive transport, and the XB-46 design, yields several satisfactory wings."

G17. Aero Memo #604 specifically suggested for use as an alternate wing Proposal #6 (preferred) and Proposal #2 (second choice) which Dr. Garbell characterized as "the two most promising proposals".

G18. The suggested wings of both Proposal #6 and Proposal #2 consist of three controlled airfoil sections having a camber distribution where the root has the least camber, the tip has greater camber and the value of the interjacent section has a camber which is equal to the value of the camber of the tip section. Proposal #6 and Proposal #2 are, accordingly, wings with a constant camber outer panel, just as disclosed by Zien in 1938 and Lachmann in 1937.

G19. District Court Judge Leon R. Yankwich in the CVAC case characterized Aero Memo #604 as the "fullest disclosure of the patent invention" which is the subject of Patent No. 2,441,758, and plaintiffs adhere to that statement in this action. 94 F.Supp. 843 at 845 (S.D. Cal.1950).

G20. The patent specification also teaches the use of camber at the interjacent section equal to that of the tip as disclosed in Aero Memo #604 (Exhibit KK). Further evidence of the pertinence of such wings is Dr. Garbell's deposition (Exhibit HT) testimony as to his basis for filing this action against Boeing. In Exhibit HT, page 86, lines 8-18, Dr. Garbell states, "I had visual evidence and comments of a seasoned airline pilot concering the excellent stalling characteristics and the confidence of this pilot in his Boeing 707 in my very first flight on the airplane. These excellent stalling characterisics do not just happen by accident in a highly tapered and swept-back wing such as

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that of the 707. I mean of the general outline of the 707 wing. On the close inspection that I had in the course of that flight, and along stop over, long, 45 minutes to an hour, I was unable to see any external indications of any device, anything different from the design geometry of

my invention". Dr. Garbell later acknowledged that that particular 707 had a constant camber outer panel as disclosed by Zien in 1938.

G21. Lachmann's camber distribution, Figure 12A of Exhibit AO, using the language of Claim 1 of the patent in suit where applicable is as follows:

> "A lifting surface with three controlled fluid-foil sections, in which the first section with the smallest mean line camber is located at the root, the second section with a greater mean line camber is located at the fluid-dynamically effective tip, and the third fluid-foil section is located at a station interjacent between the root and tip wherein the value of the mean line camber of the interjacent section, being identical to the value of the mean line camber of the tip section, is greater than the value of respective interjacent station obtainable by means of straight-line fairing between the section located at the root and the section located at the tip".

By combining an infinitesimal amount of the Lombard approach (Exhibit BC) to the Lachmann approach (Exhibit AO, Figure 12A), the word "greater" used above in characterizing the mean line camber of the tip section becomes "greatest", and Claim 1 of the patent in suit exactly characterizes the combined Lachmann-Lombard configuration.

G22. By combining an infinitesimal amount of the Lombard approach (Exhibit BC) to the Zien approach (Exhibit AP), the word "greater" used above in characterizing the mean line camber of the tip section becomes "greatest", and Claim 1 of the patent in suit exactly characterizes the combined Lachmann-Zien configuration.

G23. To aerodynamicists working prior to the time Dr. Garbell conceived his invention, it would be obvious to try such combination.

G24. In 1940, the NACA published a Report No. 703 entitled "Design Charts Relating to the Stalling of

Tapered Wings" (Exhibit I). The report described the effects of increasing camber at the tip and presented charts showing the "envelopment" and "tangency" limitations in Claims 2 and 3 and the lift distribution as called for by Claims 2, 3 and 7.

G25. The subject matter covered by Claims 1, 2, 3 and 7 would be obvious to one skilled in the art prior to the time Dr. Garbell conceived his invention when the Lachmann or Zien references are considered in combination with NACA Report 703.

G26. The subject matter of the patent in suit would be obvious to persons skilled in the art prior to the time Dr. Garbell conceived his invention when NACA Report No. 703 is considered.

G27. The Zacher article (Exhibits AJ and AJ-1), describes a wing having a camber distribution which is covered by Claims 1, 2, 3 and 7 of the patent in suit.

G28. In the Zacher article, the camber distribution of the wing is given in terms of the distribution of the angles of zero lift of the airfoil sections making up the wing. The angle of zero lift of an airfoil section is mathematically related to the camber of the section to the same extent, and with the same limitation, as the c_{l_i} or ideal lift coefficient is related mathematically to the camber of an airfoil section.

G29. The distribution of the angles of zero lift of the wing described in the Zacher article is shown by the Epsilon sub W curve in Bild 5 of Exhibit AJ. The Epsilon sub W curve shown in

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Zacher is similar to the angle of zero lift curves derived by Dr. Garbell for the airplanes he designed while at CVAC and which airplanes, as Dr. Garbell testified, had the camber distributions of Claims 1, 2, 3 and 7 of the patent in suit.

Zacher is similar to the angle of zero lift curves derived by Dr. Garbell for the airplanes he designed while at CVAC and which airplanes, as Dr. Garbell testified, had the camber distributions of Claims 1, 2, 3 and 7 of the patent in suit.

G30. A person of ordinary skill in the art at the time of the alleged invention, viewing Bild 5 of the Zacher article, and the description of the wing contained in the Zacher article, could reasonably surmise that the camber distribution of the wing described is that covered by Claims 1, 2, 3 and 7 of the patent in suit.

G31. The Zacher article was printed and published in Germany in 1944.

G32. Bild 5 and the specifications for the wing set forth in the Zacher article render the subject matter of the patent in suit obvious to those skilled in the art prior to the time of the alleged invention.

G33. A comparison of the patent with the prior art as a whole is accurately characterized by Professor Pinkerton: "I can't read anything in the patent beyond what we knew and practiced in the '30s".

G34. The level of skill in the airframe industry is extraordinary. For example, the men who appeared in court who were active in 1945 are men of considerable ability and accomplishment. Ira H. Abbott became Director of Research for NASA and responsible for the X-15 design. Orville Dunn became head of aerodynamics for Douglas, responsible for the aerodynamic design of the DC-10. William T. Hamilton designed the B-52 wing and became Director of Technology on Boeing's SST. Wesley T. Butterworth was at North American Aviation on the Appollo Program. Prof. Robert Pinkerton became a full professor at North Carolina State University. Dr. Albert E. Lombard, Jr., became Vice President, Director of Research for McDonnell Douglas. Al Riedler was not out of school in 1945, but practically upon his graduation assumed design responsibility for the Convair 880 and 990 jet transports. Dr. Garbell also verified the high level of skill found in airframe industry engineers.

Footnote 10.

G36. The Cronstedt patent, without setting out guidelines, shows the use of a third or interjacent section which could have a camber at variance with the camber obtained by straightline fairing between the tip and root sections.

G37. The Cronstedt patent rendered the subject matter of the patent in suit obvious to persons of ordinary skill in the art prior to the time Dr. Garbell conceived his invention.[11]

G38. The Crostedt patent and other referenced patents are not as pertinent as various prior art publications presented at this trial.

H. THE PATENTED COMBINATIONS ACHIEVE NO NEW RESULT.

H1. It was conceded by Dr. Garbell that there are numerous examples of wings and wing designs in the prior art in which the camber of the tip section is greater than the camber of the root section and in which there is straight-line fairing between root and tip sections. Lombard taught (Exhibit BC) that such two-section wings could be made to achieve satisfactory stall characteristics.

H2. Claims 1, 2, 3 and 7 of the patent in suit differ from the Lombard

(Exhibit BC) wing only to the extent that a third section (or more) is introduced to have a camber "at variance with" the camber which would be obtained at the same

spanwise location by straight-line fairing between the root and tip sections. No new, surprising, or synergistic result, in terms of stall performance, can be achieved over the prior art two-section wing either by increasing the camber of an interjacent section or by decreasing the camber of an interjacent section.

H3. During the course of a very extensive study of stall conducted by Boeing in 1941, Boeing achieved stall comparable in all respects to that sought by the patentee and illustrated in Fig. 3 for highly tapered (5:1) wings using a constant section wing across the span.

H4. Highly swept back or tapered wings which the plaintiffs do not claim to be infringements such as the Boeing B47, certain Boeing 707's, and certain Douglas transports such as the DC-4 and DC-6 have prior art configurations and have excellent stalling characteristics.

H5. Wings covered by the claims of the subject patent do not achieve new, surprising, or synergistic results in terms of accomplishing a combination of safe stalling characteristics, relatively low drag, and relatively high maximum lift.

H6. The Pinguino and Arcore sailplanes were designed with the help of Dr. Garbell (or by GArbell and Preti) and were flown in Italy in 1938. Each sailplane had more than two defining airfoil sections in its wing design.

H7. The camber distribution of the Pinguino sailplane would be covered by one or more of the claims of Garbell's second patent, United States Patent No. 2,498,262, which is a continuation, in part, of the patent in suit. This second patent was filed September 16, 1946, and issued February 21, 1950. Dr. Garbell acknowledged that the second patent achieved the same functional objects as the first patent.

H8. The combined coverage of the first and second patents would include the camber variations in every

wing design of three or more controlled airfoil sections in which the camber of the tip section is greater than the camber of the root section and the cambers of the interjacent sections are greater than that of the root.

H9. At Column 10, lines 50 et seq. of the patent in suit the statement appears, "Numerous flight tests and wing tunnel tests in reputable wind tunnels such as the California Institute of Technology, the Massachusetts Institute of Technology, the various wind tunnels of the National Advisory Committee for Aeronautics, and elsewhere have demonstrated convincingly that each of the objects of this invention has been fully achieved. The tests were performed on numerous wing models, on sailplanes, and on models of at least five aircraft designs of widely varying design scope employing a wide variety of airfoil series." The "flight tests" referred to were tests only of sailplanes and the Pinguino sailplane was one of the references intended to be included by the use of the term "sailplanes".

H10. Dr. Garbell acknowledged that at the time of filing of the patent in suit he was aware that the PIinguino and Arcore sailplane were fully described in printed publications in Europe during the late 1930s.

H11. Dr. Garbell conceded that the Pinguino camber distribution was covered by Claim 3 of the second patent application as filed (the '262 patent). The figures and diagrams of the second patent (Exhibit AV) are substantially identical to the figures of the first patent (Exhibit AU). Dr. Garbell conceded that he relied on the same tests of the Pinguino sailplane to demonstrate the operability of the subject matter of the second patent as he did for the first patent .

H12. Based on the fact that the camber distribution of the Pinguino sailplane is not covered by any of the claims of the patent in suit, and upon the add-

itional fact that the Pinguino sailplane had fine stalling

characteristics to which Dr. Garbell attested, it is the finding of this Court that camber distributions covered by the claims of the patent in suit would produce no new, surprising, or synergistic result in terms of stall performance over the stall performance of the prior art Pinguino and Arcore sailplanes.

H13. It is found that the patent in suit does not teach a wing construction that has a special stall characteristics.

H14. It is the finding of this Court that the teachings of the patent in suit did not solve any stall problem long existing in aircraft wing construction.

H15. It is the finding of this Court that there is no novelty or invention in the teaching of this patent of a wing having at least three sections, a root section, an interjacent section, and a tip section having a mean line camber relationship where the mean line camber is the least at the root section, the greatest at the fluid-dynamically effective tip section, and has a greater mean line camber at the interjacent section than obtainable by straight line fairing from the root section to the tip section.

H16. The patent in suit is based upon old and well-known principles in the art of aircraft wing design.

H17. The prior art fully discloses knowledge of, use of, and development of aerodynamic lifting surfaces which operated upon the principle and produced the result of the wing described and claimed inClaims 1, 2, 3 and 7 of this patent.

I. STATUTORY BAR – ON SALE, PRIOR KNOWLEDGE AND PRIOR PUBLICATION

I1. Dr. Garbell was employed by Consolidated Vultee Aircraft Company (CVAC) from September, 1942 until about October, 1945.

I2. During his employment at Consolidated Vultee Aircraft Company (CVAC), Dr. Garbell worked intensively on the XB-46 project between May and September, 1945.

I3. Dr. Garbell testified that during his employment at CVAC, it was he who proposed the wing design for the Two-Engine Tailless, the Model 107, the Model 110 and the XB-46. Dr. Garbell acknowledged that the purpose of his selection of the airfoil sections for the Tailless, the Model 107, the Model 110 and the XB-46 was to avoid stall problems. The airfoil sections used in these wings were NACA sections or slighly modified NACA sections.

I4. In May of 1945, Dr. Garbell visited the Ames Laboratory of the NACA, where he met and talked with William T. Hamilton, then with the NACA, concerning the XB-46 wind tunnel testing in progress at the NACA Ames Laboratory.

I5. Dr. Garbell acknowledged that prior to May of 1945 he proposed the shape of the XB-46 wing, was in charge of the aerodynamic design of the XB-46 wing. that he wrote the proposal submitted to the Government on the aircraft and that his design was carried out in the production of the wind tunnel model. He also testified that no change was made to the wing shape described in the specification submitted to the Government incorporated in the model or full-scale aircraft. The wing of the actual XB-46 airplane corresponds to the wing of the model. Dr. Garbell's wing configuration employed in the model and in the XB-46 airplane is covered by Claims 1, 2, 3 and 7 of the patent in suit.

I6. The specification and aerodynamic data for the XB-46 and the wing tunnel model of the XB-46 was delivered by CVAC to the custody of the United States Government and title passed prior to July 16, 1945. Payments were made to CVAC on the contract (Exhibit GT-1) which included the purchase of said wind tunnel model and the data. The amount of money paid for the wind tunnel model alone was $94,000.00.

I7. Correspondence from the United States Government (Exhibit BO) to various airplane manufacturers, for the period of April and May of 1945, shows

that the Government required that all classified data on high-speed military jet aircraft such as the XB-46 should be exchanged among airplane manufacturers.

I8. There was no seller imposed secrecy on the XB-46 specifications, data or wind tunnel model.

I9. The use and sale of the model do not come within the "experimental" exception to 35 U.S.C. sec.102.

I10. An XB-46 wind tunnel model wing, covered by Claims 1, 2, 3 and 7, was on sale to the United States Government more than one year prior to the filing date of the application which matured into the patent in suit.

I11. During the course of his employment, Dr. Garbell worked on the design of a two-Engine tailless aircraft. Dr. Garbell knew that the tailless aircraft embodying his wing design had been offered for sale to the Navy prior to May of 1944. He was responsible for the report on the design (Convair Report ZA-101, Exhibit DW) distributed to the Navy in the period of April and May of 1944, and he went by himself to meet with Captain Diehl of the Burea of Aeronautics in an attempt to sell the airplane to the Navy.

I12. The invention was thus on sale more than one year before the date of application for patent.

I13. In May of 1944, Dr. Garbell also discussed the two-engine tailless wing design described in Report ZA-101 with Ira H. Abbott of the NACA. Dr. Garbell testified that the airfoil sections of the wing shown in the report and that he discussed with Mr. Abbott and Captain Diehl were as described by Claims 1, 2, 3 and 7 in the patent in suit.

I14. The patentee disclosed the tailless report without imposing any restrictions on his disclosure, to Mr. Ira H. Abbott more than two years prior to the date

of the application which matured into the patent in suit and the wing information including airfoils were distributed by NACA to various of its research facilities.

I15. Such knowledge of the invention is public knowledge wihint the meaning of 35 U.S.C. Sec. 102.

I16. After the disclosure made to Mr. Abbott by Dr. Garbell, Mr. Abbott suggested using a three section wing to cure the tip stall problem on the XB 36 being built by Convair at Fort Worth. A wind tunnel model of a wing similar to that suggested by Mr. Abbott was built and tested by NACA and a description of the model and the test results were described in an NACA printed publication distributed and available to military aircraft designers by April 1945 (Exhibit KF).

I17. The wing described in the publication is covered by claim 11 of the patent in suit. The claims in suit, claims 1, 2, 3 and 7 are not patentable over claim 11 and so the inventions covered by Claims 1, 2, 3 and 7 were described in a printed publication before July 15, 1945.

I18. Dr. Garbell, while in the employ of CVAC, prepared a paper entitled "Effective Control of Stalling Characteristics of Highly Tapered and Sweptback Wings", dated December 5, 1944 (Exhibit PD).

I19. The paper was transmitted to the Institute of Aeronautical Sciences (IAS) on or about December 18, 1944, by Mr. T.P.Hall of the CVAC Aerodynamics Department.

I20. The paper was transmitted to the IAS with Dr. Garbell's approval and intent that the paper be reviewed by the IAS for possible presentation during a January, 1945 IAS meeting.

I21. On or about December 19, 1944, the patentee, Dr. Garbell, submitted a copy of this same paper to CVAC as an official disclosure of his invention. The disclosure made in this paper matured into the patent in this suit.

I22. The disclosure was reviewed by the IAS Editorial Board which included college professors and engineers in the airplane industry and also was reviewed by the United States War Department. The IAS informed Dr. Garbell that it in-

tended to distribute copies of the paper to company libraries and the government departments where they will be available for reference. The IAS also informed Dr. Garbell that the War Department had stated that it had no objection to presentation or publication of the paper.

I23. The disclosure to the IAS was made without any restrictions imposed by Dr. Garbell, or by CVAC; neither Dr. Garbell nor other employees of CVAC made any attempt to stop the IAS from considering publication of Dr. Garbell's disclosure.

I24. By virtue of the disclosure to the IAS, and its Editorial Board, the disclosure was distributed to a great many people more than one year prior to the date of the application which matured into the patent in suit.

I25. The disclosure constitutes a printed publication within the meaning of section 102.

J. THE PATENT IS INDEFINITE.

J1. The patent in suit is fatally indefinite because it fails to comply with the statutory requirement that the applicant shall particularly point out and distinctly claim his invention. The exterior shape of a wing establishes its aerodynamic characteristics. The specification discusses the methods of analysis enabling one to arrive at wing exterior shapes which incorporate the teachings of the patent in suit and gives concrete examples of two wing exterior shapes which the patentee considers practical embodiments of his invention. The claims of the patent in suit, however, do not define the exterior shapes of wings.

J2. Claims 1, 2, 3 and 7 define all the airfoil sections only in terms of the relative values of camber. In addition, Claims 2 and 3 include a functional limitation that either the cambers of the airfoil are "selected in such manner that" when their "maximum attainable lift coefficients" are plotted, a certain type of curve, such as Figure 2, results. Claims 2 and 3 are called herein, "diagram claims".

J3. Mean line camber is an indication of the curvature of the "mean line" of an airfoil. The mean line is a purely imaginary line in a real wing, although it can be a real line on a drawing. Camber can be thought of as merely the deviation of a curve from a straight line, or as plaintiffs prefer, measured by a term called c_{l_i}, ideal lift coefficient. In either case an infinite number of mean lines can have the same value of camber. Two curves can have the same value of geometric camber, but different values of c_{l_i}, and vice versa. Furthermore, around any given mean line, an infinite number of airfoil sections can be constructed. Therefore, no matter how precisely and definitely one specifies the camber of a mean line (excepting a straight line) it can have an infinity of shapes, and around each one of these mean line can be constructed an infinity of airfoil sections. The definition of a mean line thus tells one almost nothing about the shape of the airfoil section. That the variety of possible shapes will necessarily a variety of aerodynamic characteristics is obvious and elementary. Thus, even if these claims specified with great particularity the cambers of the root, tip and interjacent sections, which they do not, an infinite variety of airfoil sections at each of these locations could result. The number of shapes covered by each of Claims 1, 2, 3 and 7 approaches infinity to the third power (infinity^3).

J4. There is nothing in Claims 1, 2, 3 and 7 that defines any relationship among these sections, except camber. One might be blunt and full nosed, and thick in its forward portion; another, sharp at its leading edge

and have its maximum thickness well aft, while the third could have any other configuration. How all these might cooperate in the complete wing is anyone's guess. Certainly, there is no assurance that such a wing would operate to produce the results sought by the patentee. In this connection, the patentee, in his specification and examples, contemplated

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that he would use a "series" of related airfoils, such as the NACA "64-" series of his first example, throughout his example wing. However, there is absolutely nothing in these claims imposing any such limitation. In summary, then, these claims utterly fail to even approximately define the shape of a wing, and the shape is the only thing that matters.

J5. Claims 2 and 3, in effect, incorporate the diagrams of the patent, such as Figure 2. Figure 2, for example, purports to show values, by curve 6, of the "spanwise distribution of the actually prevailing section lift coefficients" (Col. 5, lines 1 and 2) and by curves 9, 11 and 8, the "spanwise distribution of maximum attainable section lift coefficients" (Col. 5, lines 14 and 15). "Actually prevailing" means just that. The only way to ascertain the "actually prevailing" values on high speed jet wings is by test. So, to establish the "actually prevailing" values on a swept wing to determine infringement, would require, at the very minimum, model tests and flight tests of some complexity. Similarly, the data required to draw the enveloping "curvilinear polygon" for a highly swept wing requires tests,

J6. The patentee does not show how to predict the behavior of highly swept-back wings of high speed jets which were unconventional in 1946. The patentee did not, and presumably could not, explain how to arrive at either the diagrams or the wing itself in the case of a highly swept wing having airfoil sections not related to one another. Thus, the public, in order to determine whether or not a proposed construction would come within the terms of the claims, would be required to

conduct extensive testing.

J7. The "diagram" claims, Claims 2 and 3, have another fatal defect: they include the functional statement "selected in such manner that . . ." at the very point of novelty.

J8. In applying Claims 2, 3 and 7 to a swept wing, the designer must know the effects of the following: fuselage (the biggest nacelle of all), pylons, nacelles, surface waviness, flap tracks, roughness, cracks, badly-worked rivet joints, and doors that haven't closed. The patent does not teach the effects of these influences on the swept wing. The only way to measure these influences would be by actual measurement of pressure on the full-scale airplane in flight.

J9. The definition of a "lifting surface" in the claims is indefinite and inadequate.

J10. The term "mean line camber" in the claims is an inadequate description of a controlled fluid-foil section.

J11. The term "mean line camber" in the claims provides an inadequate definition of the exterior shape of a wing.

J12. The term "mean line camber", as used in the claims of the patent in suit, is susceptible of more than one definition.

J13. "Mean line camber" in its literal sense is simply a property of the mean camber line or "thin wing". In the early NACA work, the camber of a mean line was expressed as the maximum rise of the mean line above the chord of the mean line (NACA Report TR 460, Exhibit A), the chord being a line connecting the leading and trailing edges of the mean line. More recently, the term "ideal lift coefficient" or c_{l_i} has been used as an indication of mean line camber. The ideal lift coefficient is a mathematically derived characteristic of the shape of a given mean line based on the principles of the thin wing theory as given in NACA TR 383 (Exhibit N).

J14. Other parameters can be used to characterize mean line camber, such as the angle of zero lift.

J15. None of the foregoing parameters of camber, viz, maximum rise, c_{l_i}, angle of zero lift, is, by itself, properly descriptive of a shape of a mean line. For example, Dr. Garbell conceded that given a value of 0.3 for c_{l_i}, a million mean line shapes would be encompassed.

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J16. The claims do not distinctly point out and claim the invention. The claims are not limited to the use of any particular parameter for measuring mean line camber. It is possible to have a single structure which would infringe if mean line camber is measured according to c_{l_i} and not infringe if mean line camber is measured according to some other parameter such as maximum rise.

J17. The claims cover everything except those combinations which the patentee acknowledged were old. The claims are indefinite and the specification inadequate for the reason that there is no indication anywhere in the patent in suit as to the amount by which the camber of the interjacent sections should be less than that at the tip, or greater than the camber of the sections obtainable by straight-line fairing between root and tip. The patent thus does not teach one skilled in the art how to practice the invention.

J18. In the development of the Convair 880, approximately 57 different wing configurations were tested, all of which had camber distribution covered by Claims 1, 2, 3 and 7 of the patent in suit. The first wing exhibited totally unacceptable stall and even the 57th wing did not show good stall characteristics in the "clean wing" case, viz, without engine nacelles and pylons. CVAC was licensed under the patent in suit and so was free to use its teachings. Nevertheless, CVAC found extensive testing necessary. The wind tunnel test

program for the Convair 880 cost on the order of $4 to $5 million dollars.

J19. Boeing in designing the wing for its 707-320 series desired for economic reasons to use as much of the 707-120 series as it could. To arrive at a satisfactory wing for the 707-320, Boeing found that it required testing of about 40 wing models. During the latter stages of testing, the wind tunnel was used full time for two months.

J20. McDonnell Douglas began serious design efforts on the DC-10 project in about 1967, some four years after this lawsuit was filed. Judicial notice is taken of the fact that the patent in suit had expired in 1965 and of the fact that McDonnell Douglas would have been free to use the Garbell disclosure in the design of the DC-10. Twenty-six wing configurations were tested during the DC-10 development program. Total test time amounted to a figure somewhere between 10,000 and 15,000 wind tunnel hours, ranging in cost from $1,200 per hour for low-speed wind tunnel tests and $2,000 per hour for high-speed wind tunnel tests.

J21. The patent in suit did not, and cannot, obviate any of the expensive test work and cut and try design which goes into the development of the wing of a high-speed commercial jet transport.

J22. Extensive experimentation is still necessary for persons of ordinary skill in the art to design the optimum wing shape for a given aircraft.

J23. The Garbell patent assumes the existence of a mean line in every airfoil section. There are many possible definitions of mean line, but for the purposes of this litigation the NACA definition of a mean line is used. (See Court's Exhibit 1). The NACA definition of a mean line, as set forth in Exhibit 36-1 (page 65), states, in substance, that the mean line is the locus of points midway between the upper and lower surfaces of an airfoil section measured perpendicular to the mean line. The NACA definition poses no difficulty with regard to

standard NACA airfoil sections because those sections were constructed initially from mean lines, i.e., by superimposing symmetrical thickness distributions about given mean lines. However, the problem of ascertaining precisely a mean line in an airfoil section which has not been predefined with a mean line is extremely difficult.

J24. In the design of the accused DC-8 wing, Douglas aerodynamicists designed their own airfoil sections for specific application to the DC-8 wing.

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The Douglas airfoil sections, bearing "DSMA" designations, were designed without the use of mean lines. The Douglas aerodynamicists had advanced the art of airfoil design to the point where they were concerned only with the properties associated with the exterior surface of the airfoil section, and not with any theoretical properties of an imaginary mean line.

J25. In an attempt to prove that the DC-8 wing designs infringe the claims of the patent in suit, plaintiffs set about the task of trying to ascertain mean lines in the DSMA airfoil section for which no mean lines had been prescribed by Douglas. Prior to trial plaintiffs produced at least four sets of mean line camber values for the DSMA airfoil sections, summarized in Exhibit KQ. Dr. Garbell, in response to questions concerning the four sets of mean line camber values, admitted that one would find infringement or non-infringement depending upon the choice of individual mean line camber values from the four values for each airfoil section.

J26. The strongest evidence adduced as to the difficulty of ascertaining a mean line where one is not preselected is the fact that plaintiffs felt it necessary to engage the services of a computer programmer, Mr. Lynn Teuscher, to develop a computer program for finding mean lines in arbitrary airfoil sections. Dr. Garbell admitted that the computer program was unique and that plaintiffs had spent what they considered a monumental sum, approximately $4,000, in developing the computer

program. Dr. Garbell also admitted that plaintiffs had sought a protective order to prevent defendants from using Mr. Teuscher's computer technique for finding mean lines.

J27. The Court notes the fact that there is no language in the patent which explains how one might go about the job of finding a mean line in an airfoil section which is not predefined with a mean line. It requires the exercise of extraordinary effort and experimentation to ascertain mean lines in non-NACA airfoil sections.

K. THE PATENT CLAIMS COVER INOPERABLE EMBODIMENTS.

K1. The claims of the patent in suit are overbroad in that they cover non-useful embodiments even for non-highly swept wings.

K2. The patent in suit teaches a dangerous stall pattern, as evidenced in Figure 2 of the patent.

K3. Figure 2 of the patent, and the language of the patent specification, teach the use of a "close envelopment" of the curve of actually prevailing section lift coefficients by the curve of maximum attainable section lift coefficients. Such a design invites simultaneous stall over a substantial portion of the wing semispan. It was known in the art at the time of the alleged invention that simultaneous stall over a large portion of the wing semispan should be avoided for the reason that one wing might stall slightly earlier than its opposite wing and result in a difficult and possibly uncontrollable roll behavior. As Zien observed, "The lateral controllability in the stalled flight attitude is bad" (Exhibit AP-1, p.14). NACA Technical Report 703 (Exhibit I) and NACA Technical Note No. 713 (Exhibit J) taught the use of a substantial margin between the $C_{l_{max}}$ and C_l curves over the outer panel of a given wing in order to avoid the hazards of non-symmetrical stalling. The teachings of the foregoing NACA treatises prospectively refuted the Garbell teaching as to the quality of stall which should

be obtained.

K4. Professor Pinkerton, Mr. Abbott, Mr. Sivells, and Dr. Oswald, one of plaintiffs' witnesses, were unanimous in their opinions that the "close envelopment" teaching of the patent, as illustrated in Figure 2 of the patent, is a dangerous and impractical approach to stall control.

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K5. Mr. Abbott explained that the reason the NACA urged the use of a substantial margin between the $C_{l_{max}}$ and the C_l curves is that it is impossible, as a practical matter, to assure that the stall behavior of the right wing will be identical to the stall behavior of the left wing so that simultaneous and symmetrical stalling will occur. Atmospheric disturbances such as turbulence and buffeting are practical considerations which make it unreasonable to rely upon the exactitude of the stall diagrams. As Dr. Oswald put it, on cross-examination by defense counsel:

> "(Question) Would you call the stall inception that you get based on that depiction, Figure 2, a good stall? Would that represent a good stalling wing?
>
> (Answer) No, I would say this is not good. It seems to have stalled at almost all spanwise stations. If this would be used, one could expect that the unknown were greater than the differences shown here."

Mr. Orville Dunn, Director of Aerodynamics at the Long Beach, California facility of the defendant McDonnell Douglas Corporation, was even more emphatic in his mistrust of the type of stall recommended by the patentee:

> "(Mr. Dunn) This shows a condition of stall inception in which the wing would appear to being stalling simultaneously at .7 (point 7) and in the region between .5 (point 5) and .11 (point 11) – in other words, a lot of this wing is going to stall at once.
> (Answer) In the vernacular, that is a lousy wing."

K6. The patent methodology does not apply to highly swept-back wings such as the accused wings.

K7. The McDonnell Douglas DC-8 and DC-9 airplanes, the Boeing 707 airplanes and the General Dynamics Model 880 airplanes are representative of modern jet transports. These airplanes have wings that are highly swept-back and highly tapered as those terms are used in the patent.

K8. The methodology of the patent in suit depends substantially on the validity of two-dimensional flow principles.

K9. The outwardly directed spanwise boundary layer flow on a swept wing causes the airfoil sections near the tip of the swept wing to achieve much lower values of maximum lift capability than would be indicated for the same airfoil sections in the two-dimensional wind tunnel tests.

K10. The outwardly directed spanwise boundary layer flow phenomenon on a swept wing has the opposite effect on the airfoil sections near the root. They achieve far greater maximum lift capability than would be obtained for the same section in two-dimensional wind tunnel tests of those sections.

K11. Thus, the existence of three dimensional flow including an outwardly directed spanwise flow on swept wings makes the assumption of two-dimensional flow behavior meaningless in swept wing designs.

K12. This was demonstrated by Harper and Maki in their paper on the stall characteristics of highly swept wings, NASA TN D–2373 (1964; Exhibit HY-1). Mr. Abbott referred to Figures 11 and 12 of Exhibit HY-1 as illustrating the phenomena experienced on swept wings where sections near the tip do not attain the $C_{l_{max}}$ values one would expect from two-dimensional tests of those sections. Mr. William T. Hamilton offered the physical explanation that the spanwise flow phenomenon

on swept wings causes dead air or stagnant air to be transported to the outer wing panel, causing that portion of the swept wing to become more susceptible to stall. The type of camber distribution in a given highly swept wing has little or no effect on the tip-stall propensity of the swept wing because the spanwise boundary layer phenomenon far overshadows whatever beneficial effects can be gained from judicious camber selection.

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K13. The Convair 880 Jet Transport wing, which has a camber distribution covered by claims 1, 2, 3 and 7 of the patent showed marked tip stall in wind-tunnel tests without the presence of engine nacelles and pylons.

K14. In the development of the accused DC-8 swept wing jet airplanes, defendant Douglas Aircraft Company found it could not control or prevent tip stall by the selection of airfoil sections. Pylon mounted engines used on the DC-8 airplanes controlled the spanwise flow of the boundary layer air to force the inboard panel to stall first, which Douglas considered necessary for good stall characteristics.

K15. One of the principal indicators of tip stall on a swept wing is the pitch behavior of the wing at stall. On a swept wing, the tip lies much farther aft than the root. In order to achieve the proper alignment of lift forces with respect to the center of gravity of the airplane as a whole, the tip of a swept wing inevitably lies behind, or aft of, the center of gravity of the airplane. The loss of lift in the tip region (associated with tip stall) on a swept wing means there is less upward force behind the center of gravity of the airplane, the net effect being equivalent to an upward force on the nose of the airplane, i.e., forward of the center of gravity. Tip stall on a swept wing, therefore, produces a tendency for the airplane to pitch up at stall, an undesirable characteristic.

K16. Mr. Hamilton presented pitching moment data on certain of the Boeing swept wings (Exhibits SA and SB) studied in connection with Boeing's B-52 development. All of them, including those with camber covered by Claims 1, 2, 3 and 7 showed pitch-up moments for the wing-body alone configuration, indicating tip stall. Mr. Hamilton also indicated that all of the swept wing designs with which he had been associated at Boeing, including the B-52, the 707, and several others, had demonstrated the same type of pitch behavior, a strong tendency to pitch up at the stall in the clean-wing configuration. However, the complete airplanes, including engine nacelles and pylons, and tail assemblies, showed either no pitch up at the stall, or some favorable pitch down at the stall.

K17. Among the highly swept-back jet airplanes that have been manufactured by defendant Boeing are bombers, the B-47 with 35 degree swept wings, the B-52 with 35 degree swept wings, and commercial airplanes, the 707 with 35 degree swept wings, the 727 with about 40 degree swept wings. Boeing remedied the effects of tip stall on these airplanes by means other than the use of camber distribution.

K18. Mr. Riedler, formerly of Convair, Mr. Dunn of Douglas and Mr. Hamilton of Boeing were unanimous in the view that the safe stalling characteristics of their respective commercial jet wing design were directly attributable to horizontal tail design and to the presence of external wing appendages, such as engine nacelles and pylons, which act in such a manner as to produce a vortex over the wing which breaks up, or mitigates the spanwise boundary layer flow on the swept wing, and to the presence of tail assemblies.

K19. The principle or mode of operation of the patent in suit, viz, the use of a non-straight-line faired camber distribution across the wing, cannot accomplish the object of the patent in suit of preventing tip stall on a highly swept wing.

L. COMMERCIAL SUCCESS AND LONG–FELT NEED.

L1. Plaintiffs have not proved that the alleged invention of the patent in suit has met with commercial success. Their proof in this regard is meager at best and consists of testimony that wings covered by the patent in suit had been used on Consolidated Vultee Aircraft Corporation's commercial airplanes, essentially the Models 240, 340, 440 and

880 whose wings were claimed by Dr. Garbell to have been derived from the wing of the CVAC Model 110 designed at the time Dr. Garbell worked for CVAC. No sales or other documentation was ever presented at the trial to permit a meaningful appraisal of the commercial success, or to establish that such sales were attributable to the patent in suit.

L2. Dr. Garbell admitted that CVAC was the only licensee under the patent in suit. "On April 16, 1954," CVAC acquired a license to all of Dr. Garbell's patents for a $8,302.79 judgment.

L3. When offered a license under the application which became the patent in suit, the evidence showed that airframe manufacturers considered the claimed invention to be old, unpatentable and not powerful enough to solve stall problems on swept wing jets.

L4. There is no evidence that CVAC or anyone ever constructed the wing by following the patent in suit.

L5. Plaintiffs have not met their burden of proving commercial success or long felt need. In any event these secondary considerations are inapplicable since the invalidity of the patent is not open to doubt.

M. ESTOPPEL.

M1. The defendants Boeing and McDonnell Douglas were not parties in the prior suit, involving this same patent, brought by plaintiffs on January 18, 1950 against Consolidated Vultee Aircraft Corporation (Civil Action No. 10930-Y).

M2. The Manufacturers Aircraft Association , Inc. was not a party in such prior suit, nor were any of its members, other than Consolidated Vultee Aircraft Corporation, a party in such action. The Manufacturers Aircraft Association, Inc. is a New York corporation having as its stockholders virtually every airframe manufacturer in the United States including Boeing and McDonnell Douglas. Each stockholder has one share of voting stock.

M3. The Manufacturers Aircraft Association is a patent service organization. It administers cross-license agreements for its members. It maintains a library devoted to the airplane art which includes copies of United States and foreign patents, books, magazines and other writings having subject-matters of interest to the airplane industry. It performs searches of the prior airplane art at the request and to assist its members in the conduct of their patent operations.

M4. There is no evidence whatsoever that either the Manufacturers Aircraft Association or its members bore any part of the litigation costs of, or in anywise controlled the conduct of the defense of the prior suit against Consolidated Vultee.

M5. There is no evidence that Manufacturers Aircraft Association bore any costs of present suit or controlled defense in any way or controlled preparation or investigation conducted by defendants in present case or CVAC case. Full and sole control of suit was by the defendants and all costs borne solely by defendants.

M6. The fact that Consolidated Vultee sought and obtained assistance from the Manufacturers Aircraft Association and various of the members in finding prior art which Consolidated Vultee used in its suit did not make the Association or its members parties to that prior suit.

M7. It is clearly reasonable that an airplane manufacturer, defending himself in a patent infringement suit involving his airplanes, should make inquiries of and seek assistance of other airplane manufacturers and any others having experience in the airplane art in his attempt to develop prior art.

M8. The defendants Boeing and McDonnell Douglas have the right in the present suit on Patent No. 2,441,758 to

urge all appropriate defenses provided by the patent statutes of the United States.

M9. Substantial new evidence, both oral and documentary, by way of explanation and additional grounds for finding invalid were urged and proved in support of defendants' contentions in this case over and above that produced in the CVAC case.

M10. Boeing and McDonnell Douglas have the right to rely on the evidence produced in the CVAC case without being bound by the results in the trial of that action. Evidence presentation in that CVAC case took four days on infringement and validity as compared to twenty days in this case in addition to which there were twenty-nine days of hearings before the Special Master on prior art and McDonnell Douglas accused aircraft wing definition.

M11. Defendants are not bound by the trial court decision in the CVAC case and are not estopped to assert invalidity of the patent in suit.

J. JUSTIFICATION FOR AN AWARD OF ATTORNEYS' FEES.

N1. The plaintiffs before-trial proceedings in this action make this case one that is extraordinary.

N2. These actions were not filed or maintained in good faith.

N3. When deposed as to the basis for his filing of the complaint in this action against the defendant Boeing, Dr. Garbell stated, "I had visual evidence and comments of a seasoned airline pilot concerning the excellent stalling characteristics and the confidence of this pilot in his Boeing 707 in my very first flight on the airplane. These excellent stalling characteristics do not just happen by accident in a highly tapered and sweptback wing such as that of the 707". This first flight of Dr. Garbell's on the Boeing 707 occurred on December 25, 1960, and the pilot referred to is Wesley Gray. Dr. Garbell now knows that this Boeing 707 does not infringe the patent in suit.

N4. Plaintiffs failed to use reasonable care in assessing their allegation that the wing of the Boeing 707 infringed the patent in suit. Boeing filed a motion for an early and separate trial in the issue of infringement. Plaintiffs opposed the motion. Among other things they charged "that by no stretch of the imagination can" WBL-6 "constitute an airfoil section which defines . . . the exterior shape of" the 707-320 B/C wing. Plaintiffs now admit that the root section of the wing is that asserted by Boeing, i.e., WBL-6. Throughout the lengthy history of this case, plaintiffs have not sought to go to trial on the issue of infringement in the Boeing case.

N5. When deposed as to the basis for his filing of the complaint in this action against the defendant Douglas, Dr. Garbell stated that it was based on a single flight he had on a DC-8 on December 26, 1960. The flight was of 70 minutes duration.

N6. In the course of this litigation, defendant Douglas moved for partial summary judgment with respect to the DC–9 aircraft. Plaintiffs countered with a motion for partial summary judgment to have the DC–9 aircraft wing found to be a willful infringement. However, a few months later in the Special Master hearing, plaintiffs dropped any claim based on the DC–9 wing.

N7. Plaintiffs' failure, more than seven years after the case was filed with regard to the infringement allegation directed to the DC-8 airplane wings, to furnish new evidence as to the camber values of airfoil sections of such wings located inboard of the controlled airfoil section at the 28% station, though repeated requested to do so by the Special Master, was irresponsible and inexcusable.

N8. The plaintiffs denied requests for admissions directed to the airfoil section parameters, including mean-line

camber, of the prior art Curtiss-Wright Models 21B and 23 aircraft. Issues as to the shape of such wings were tried by the Special Master and the Special Master made his findings with respect to such parameters. Plaintiffs objected to such findings before the Court trial; then at the trial, plaintiffs introduced documentary evidence which substantiated fully the Special Master's findings as to the wing geometry of those aircraft and also proved that the Models 21B and 23 wings showed aerodynamic improvements over previous Curtiss-Wright models. That the Curtiss-Wright Models 21B and 23 aircraft invalidate Claims 1, 2, 3 and 7 of the patent in suit appears elsewhere in these findings and in the Conclusions of Law.

N9. Plaintiffs put in evidence opinions that the patent in suit was anticipated.

N10. Plaintiffs put in evidence that a description of a wing design covered by the patent was circulated in the NACA, a public body, before the earliest date the patentee can claim as a reduction to practice, i.e., the filing date of the patent application.

N11. From the evidence offered by the plaintiffs, without limitation in Exhibits 686 and 695, the plaintiffs knew that patent was invalid and yet continued to pursue the action.

N12. Plaintiffs have used the patent in an attempt to exact undue tribute from the two defendants.

N13. The Pinguino sailplane designed by Dr. Garbell and Dr. Preti was described in printed publications in Europe in the '30s. In the patent in suit, Dr. Garbell referred to flight tests of the Pinguino as "demonstrating convincingly that each of the objects of this invention has been fully achieved". The Pinguino wing was expressly covered by Claim 3 of the continuation-in-part application which matured into Patent No. 2,498,262.

N14. Shortly after Dr. Garbell applied for the patent in suit, he acknowledged that the invention covered by the application had been test-flown before he went to work for CVAC. The test flights referred to were those of the Pinguino, described in printed publications many years before the patent application was filed.

N15. Notwithstanding, in both the original patent application and the continuation-in-part application which specifically claimed the Pinguino wing, Dr. Garbell signed an oath that the claimed invention had not been described in printed publications. Such conduct is below the standards of good faith and candor required of inventors dealing with the Patent Office.

N16. The plaintiffs had no meaningful evidence upon which to base their allegations of infringement prior to filing the complaints in these actions. They opposed Boeing's request for an early trial on the Boeing infringement issue. Plaintiffs refused to go to trial on

the remand to the Special Master for additional findings on the Douglas infringement issue, after they discovered his initial findings were unfavorable to them. Plaintiffs presented evidence in this trial which they have had in their possession since 1967, and which would support a finding that the patent was invalid.

N17. The conduct of plaintiffs as outlined in these finding is wholly unjustified and amounts to bad faith. It would be unconscionable to require defendants to bear the burden of their defense cost.

N18. Such conduct warrants an award of reasonable attorneys' fees which are fixed in the amount of $237,062.50, the court finding that counsel for defendants have reasonably expended 18,525 hours in the legal work and litigation necessarily incurred and performed in the proper and adequate defense of this action.

The following Conclusions of Law, insofar as they may be considered Find-

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ings of Fact, are also found by theCourt to be true in all respects.

From the foregoing facts, the Court concludes as set forth hereafter.

CONCLUSIONS OF LAW

1. This Court has jurisdiction of the parties and of the subject matter of these actions.

2. The patent in suit and Claims 1, 2, 3 and 7 do not meet the test of novelty and utility within the meaning of 35 U.S.C. sec. 101[12] and are therefore invalid.

3. Each of Claims 1, 2, 3 and 7 covers the prior art Curtiss-Wright Models 21B and 23 wings. Since such wings would infringe if new and anticipate if old, the

alleged invention does not meet the test of novelty under 35 U.S.C. sec. 101.

4. The subject matter of Claims 1, 2, 3 and 7 of the patent in suit involves the mere substitution of equivalents which do substantially the same thing in the same way as prior art devices described in the Zien article, the Lachmann article, the Cronstedt patent and in the Pinguino and Arcore sailplane articles and therefore is not such an invention as will sustain a patent under 35 U.S.C. sec. 101. Dow Chemical Co. v. Halliburton Oil Well Cem. Co., 324 U.S. 320, 330, 65 S.Ct. 647, 89 L.Ed. 973 (1945); Elliott Core Drilling Co. v. Smith, 50 F.2d 813, 816 (9th Cir. 1931); Kwik Set, Inc. v. Welch Grape Juice Co., 86 F.2d 945, 947 (2nd Cir. 1936); Hazeltine Corporation v. General Motors Corporation, 131 F.2d 34, 39 (3rd Cir. 1942); Talon, Inc. v. Union Slide Fastener, Inc., 266 F.2d 731, 735 (9th Cir. 1959).

/1/5. To the extent that the validity of Claims 1, 2, 3 and 7 of the patent in suit depends on a combination of elements that produces in some way or manner a surprising or unusual result which would have been expected by a person having ordinary skill in the art, the patent in suit does not meet this test. Great Atlantic and Pacific Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147, 71 S.Ct. 127, 95 L.Ed. 162 (1950); Anderson's Black Rock, Inc. v. Pavement Salvage Co., Inc., 396 U.S. 57, 90 S.Ct. 305, 24 L.Ed.2d 258 (1969); Spring Crest Company v. American Beauti Pleat, Inc., 420 F.2d 950, 951 (9th Cir. 1970); Hamlow v. Scientific Glass Apparatus Corp., 421 F.2d 173, 174 (9th Cir. 1970).

6. Removal of the tip panel from the Zien wing results in a wing covered by Claims 1, 2, 3 and 7 of the patent in suit. Such "omission of an element and the function of the element in a prior art device does not constitute invention" which 35 U.S.C. sec. 101 declares to be patentable. Richards v. Chase Elevator Co., (1895) 159 U.S. 477, 486, 16 S.Ct. 53, 40 L.Ed. 225; Grayson Heat Control v. Los Angeles, 134 F.2d 478, 481 (9th Cir. 1943).

7. Claims 1, 2, 3 and 7 of the patent in suit cover structures which are capable of achieving the type of stall which the patentee desires, as illustrated in Figure 2 and which practical experience rejects as dangerous. Such claims read upon non-useful structures, therefore, and lack statutory utility. In re Cook & Merigold, 439 F.2d 730, 735, 58 CCPA 1049 (1971); Graver Tank & Mfg. Co. v. Linde Air Products, 336 U.S. 271, 276-277, 69 S.Ct. 535, 93 L.Ed. 672 (1949).

8. Claims 1, 2, 3 and 7 of the patent in suit are invalid for the reason that they read upon non-useful embodiments and inoperative embodiments in highly-swept wings. The claims therefore lack statutory utility within the meaning of 35 U.S.C. sec. 101. Butterfield v. Oculus Contact Lens Co., Inc., 332 F.Supp. 750, (D.C.N.D.Ill., 1971). In re Cook & Merigold, 439 F.2d 730, 735, 58 CCPA 1049 (1971).

9. It is concluded that no person or entity ever reduced the alleged invention to practice on behalf of, or as agent for, the patentee and that the earliest date on which plaintiffs can rely is the constructive reduction to practice occurring on July 16, 1946, with the filing of the application which matured into the patent in suit. Consolidated Vultee Aircraft Corporation v. Garbell, 204 F.2d 946, 949 (9th Cir. 1953).

10. The subject matter of the patent was well known by others prior to the time of the alleged invention within the meaning of 35 U.S.C. sec. 102(a).[13] The Curtiss-Wright Models 21B and 23 anticipate and read on Claims 1, 2, 3 and 7 of the patent in suit and consequently devices covered by such claims were known or used by others prior to the time of the alleged invention within the meaning of 35 U.S.C. sec. 102(a). These claims are invalid thereunder. Monolith Portland Midwest Co. v. Kaiser Aluminum & Chemical Corporation, 267 F.Supp. 726, 783 (D.C. Cal.1966), modified as to amount of attorneys' fees awarded to defendant, 407 F.2d 288 (9th Cir. 1969).

11. Claims 1, 2, 3 and 7 of the patent in suit read upon the wing of the Curtiss-Wright Model 23 and the wing of the Curtiss-Wright Model 21-B. The Curtiss-Wright Model 23 and the Model 21-B were in public use and on sale in this country more than one year prior to the date of the application which matured into the patent in suit, within the meaning of 35 U.S.C. sec. 102(b).[13] Celite Corp. v. Dicalite Corp., 96 F.2d 242 (9th Cir. 1938); H.K.Regar & Sons v. Scott & Williams, Inc., 63 F.2d 229 (2nd Cir. 1933); Monolith Portland Midwest Co. v. Kaiser Aluminum & Chemical Corporation, 267 F.Supp. 726, 783 (D.C. Cal. 1966), modified as to amount of attorneys' fees awarded to defendant, 407 F.2d 288 (9th Cir. 1969); Piet v. United States, 176 F.Supp. 576 (D.C.S.D. Cal. 1959), aff'd per curiam 283 F.2d 693 (9th Cir. 1960).

12. The Zacher article on the D-30 Cirrus was a "printed publication" within the meaning of 35 U.S.C. sec. 102(b). Bild 5, or Figure 5, of the Zacher article shows a camber distribution for the D-30 Cirrus wing on which claims 1, 2, 3 and 7 of the patent in suit read. Thus, the invention was described in a printed publication in a foreign country more than one year prior to the filing of the application which matured into the patent in suit.

13. The XB-46 wing, covered by Claims 1, 2, 3 and 7 of the patent in suit, as described in the specification submitted by CVAC to the Air Force, was on sale more than one year prior to the date of the application which matured into he patent in suit, within the meaning of 35 U.S.C. sec. 102(b). A wind tunnel model of the XB-46 airplane wing covered by Claims 1, 2, 3 and 7 of the patent in suit, was sold and delivered to the United States Government more than one year prior to the date of the application which matured into the patent in suit. Elizabeth v. Pavement Co., 97 U.S. 126, 135, 24 L.Ed. 1000 (1877); Piet v. United States, 176 F.Supp. 576, 581-584 (D.C.Cal. 1959), aff'd per curiam, 283 F.2d 693 (9th Cir. 1960); Amphenol Corp. v. General Time Corp., 397 F.2d 431, 433 (7th Cir. 1968); Tucker Aluminum

Products, Inc. v. Grossman, 312 F.2d 293 (9th Cir. 1963). There were absolutely no conditions of secrecy imposed by the inventor, Dr. Garbell, on the United States Government or on CVAC, the contractor, or imposed by CVAC on the United States Government. The invention was therefore on sale within the meaning of 35 U.S.C. sec. 102(b) more than one year prior to the date of application which matured into the patent in suit. Piet v. United States, 176 F.Supp. 576, 584 to

586 (D.C.Cal.1959), affirmed per curiam, 283 F.2d 693 (9th Cir. 1960).

14. A proposal for a two-engine tailless airplane was presented to the United States Government by Dr. Garbell and others on behalf of CVAC more than one year prior to the date of the application which matured into the patent in suit, for the purpose of selling such airplanes to the Government. Claims 1, 2, 3 and 7 of the patent in suit cover the wing described in the tailless airplane proposal. By reason of such selling activity, the invention was on sale more than one year prior to the application date within the meaning of 35 U.S.C sec. 102(b).

15. More than one year prior to the date of the application which matured into the patent in suit, Mr. Ira Abbott of the National Advisory Committee on Aeronautics (NACA) proposed a new wing design for the XB–36 airplane, which design was covered by Claim 11 of the patent in suit. A description of the model and results of tests of the wind tunnel model covered by Claim 11 and embodying a design similar to Mr. Abbott's design for an improved XB–36 wing were reported in a printed publication more than one year prior to the date of application for the patent in suit. Claim 11 is not patentably distinct from Claims 1, 2, 3 and 7 and therefore the invention covered in Claims 1, 2, 3 and 7 were described in a printed publication more than one year prior to the date of application which matured into the patent in suit within the meaning of 35 U.S.C. sec.

102(b). Tool Research and Engineering Corp. v. Honcor Corp., 367 F.2d 449, 454 (9th Cir. 1966); Super Mold Corporation v. Clapp's Equipment Division, Inc., 397 F.2d. 932 (9th Cir. 1968), rehearing denied; 2 Walker, Patents (Deller's 2nd Ed., 1964) sec. 141; Talon, Inc., v. Union Slide Fastener, Inc., 266 F.2d 731, 735 (9th Cir. 1959).

16. More than one year prior to the date of the application for the patent in suit, Dr. Garbell submitted a manuscript containing a description of the teachings and subject matter of his alleged invention to the Institute of Aeronautical Sciences (IAS) with the intent that said manuscript would be published. The manuscript was distributed by the IAS to a great number of people in the airframe industry. Dr. Garbell's manuscript constituted a printed publication of the alleged invention more than one year prior to the date of the application which matured into the patent in suit within the meaning of 35 U.S.C. sec. 102(b). Hamilton Laboratories v. Massengill, 111 F.2d 584 (6th Cir. 1940); Application of Tenney, 254 F.2d 619, 45 C.C.P.A. 894 (1958); Garrett Corporation v. United States, 422 F.2d 874, 878, 190 Ct.Cl. 858 (1970); Philips Electronic & Pharmaceutical Industries Corp. v. Thermal and Electronics Industries, Inc., 450 F.2d 1164 (3rd Cir. 1971).

17. The wing of the Curtiss-Wright Models 21-B and 23 was a prior invention (i.e., reduced to practice prior to July 16, 1945) which was not abandoned, suppressed or concealed within the meaning of 35 U.S.C. sec. 102(g).[14] Corona Cord Tire Co. v. Dovan Chemical Corp., 276 U.S. 358, 48 S.Ct. 380, 72 L.Ed. 610 (1928).

18. The subject matter of the patent in suit, taken as a whole, would have been obvious to persons of ordinary skill in the art prior to the time of the alleged invention, 35 U.S.C. sec. 103,[15] Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 86 S.Ct. 684, 15 L.Ed.2d 545 (1965); Walker v. General Motors Corporation, 362 F.2d 56 (9th Cir. 1966); Great Atlantic and Pacific Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147, 71 S.Ct.

127, 95 L.Ed. 162 (1950).

19. The teachings of the Zien article, the Zacher article, the Lachmann article,

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the Lombard article, the Cronstedt patent and numerous NACA technical reports and technical notes in evidence, singly or in combination, render the subject matter of the patent in suit obvious to persons of ordinary skill in the art prior to the time of the alleged invention within the meaning of 35 U.S.C. sec. 103.

/2/20. Invalidity of the patent is not in doubt and therefore secondary considerations of commercial success and long-felt need have no relevancy. However, plaintiffs have not established commercial success attributable to the patented wing. Heath v. Frankel, 153 F.2d 369 (9th Cir. 1946), cert. denied, 328 U.S. 844, 66 S.Ct. 1025, 90 L.Ed. 1618. The evidence establishes that there was no long-felt need. Jeddeloh Brothers Sweed Mills, Inc. v. Coe Manufacturing Co., 375 F.2d 85 (9th Cir. 1967).

21. The teachings of the patent in suit cannot be employed without the necessity for an elaborate experimentation. Each of Claims 1, 2, 3 and 7 of the patent in suit is drawn so broadly as to encompass innumerable embodiments, some of which may achieve the objects of the patent, and many of which may not achieve the objects of the alleged invention. Knowing nothing more than the fact that one or more of the claims in issue reads upon a given device, one can have no assurance that said device would achieve the functional objects of the patent without elaborate testing both in wind tunnel and in flight conditions. The specification does not provide sufficient guidance to remove the necessity for independent experimentation. It is the conclusion of this Court that the disclosure of the patent in suit lacks sufficient precision to meet the requirement of 35 U.S.C.

sec. 112.[16] H.C. Baxter and Bros. v. Great Atlantic and Pacific Tea Co., 236 F.Supp. 601, 611 (D.C. Me. 1964); Reeves Brothers, Inc. v. U.S. Laminating Corp., 282 F.Supp. 118, 128 (D.C.E.D.N.Y.1968).

22. The specification does not teach one skilled in the art how to avoid tip stall on swept wings for use on commercial jet transports and for that reason is void under 35 U.S.C. sec.112. O'Reilly v. Morse, 56 U.S. (15 How.) 62, 119, 14 L.Ed. 601 (1853).

23. The specification provides no guidance to the user of arbitrary airfoil sections on the critical matter of ascertaining mean lines in arbitrary airfoil sections where the mean line was not pre-selected. The specification for this reason does not meet the requirements of 35 U.S.C. sec. 112.

24. The patent in suit and each of Claims 1, 2, 3 and 7 fail to define the exterior shape of a wing in that the claims speak only in terms of relative camber distribution and encompass an infinite variety of wing shapes. One skilled in the art is complelled to experiment in order to find an operable combination. The patentee therefore has claimed more than his purported invention and the claims are thus void under 35 U.S.C. sec. 112. Libbey Owens-Ford Glass Co. v. Celanese Corp., 135 F.2d 138, 146 (6th Cir. 1943).

25. The term "mean-line camber" as used in Claims 1, 2, 3 and 7 of the patent in suit, has more than one definition. Infringement or non-infringement of these claims depends on which definition is used. Two persons skilled in the aerodynamics art working with the identical airfoil shape could find two different mean line camber values for the airfoil section. Since the claims cover relative camber values, one aerodynamicist could find infringement while the other aerodynamicist could find non-infringement for the same wing. For this reason, it is concluded that Claims 1, 2, 3 and 7 of the patent in suit do not meet the requirement of 35 U.S.C. sec. 112.

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26. Claims 2, 3 and 7 of the patent in suit incorporate the diagrams of the patent, such as Figure 2 and Figure 4. Figure 2, for example, purports to show values, by curve 6, of the "spanwise distribution of the actually prevailing section lift coefficients" (Col. 5, lines 1 and 2) and by curves 9, 11 and 8, the "spanwise distribution of maximum attainable section lift coefficients" (Col. 5, lines 14 and 15). "Actually prevailing" means just that. The only way to ascertain the "actually prevailing" values on high speed jet wings is by test. So, to establish the "actually prevailing" values on a swept wing to determine infringement would require, at the very minimum, model tests and flight test of some complexity. Similarly, the data required to draw the enveloping "curvilinear polygon" for a highly swept wing requires tests. The patentee does not show how to predict the behavior of highly swept-back wings of high speed jets which were unconventional in 1946. The patentee did not, and presumably could not, explain how to arrive at either the diagrams or the wing itself in the case of highly swept wing having airfoil sections not related to one another. Thus, the public, in order to determine whether or not a proposed construction would come within the terms of the claims, would be required to conduct extensive testing. Therefore, since "the inventor must inform the public during the life of the patent of the limits of the monopoly asserted, so that it may be known which features may be safely used or manufactured without a license and which may not", Claims 2, 3 and 7 of the patent in suit do not meet the requirement of 35 U.S.C. sec. 112. General Electric Co. v. Wabash Appliance Corp., 304 U.S. 364, 369, 58 S.Ct. 899, 901, 82 L.Ed. 1402 (1938). Claims 2, 3 and 7 of the patent in suit do not meet the requirement of 35 U.S.C. sec. 112 in that "no inventor may compel independent experimentation by others to ascertain the bounds of his claims". Standard Oil v. Tide Water Associated Oil Co., 154 F.2d 579, 582-583 (3rd Cir. 1946).

27. To the extent that Claims 2, 3 and 7 of the patent in suit purport to express functional limitations on otherwise broadly defined structures, said claims are invalid for the reason that said limitations appear at the point of novelty and for the further reason that the specification is an inadequate guide to defining the acts and structures implied by said functional limitations. Cementing Co. v. Walker, 329 U.S. 1, 67, 67 S.Ct. 6, 91 L.Ed. 3 (1946); Stearns v. Tinker & Rasor, 252 F.2d 589, 599 (9th Cir. 1957).

/3, 4/ 28. The usual presumption of patent validity (35 U.S.C. sec. 282) is vitiated in this case by reason of the fact that the applicant did not cite to the Patent Office, and the Patent Office did not consider, the most pertinent prior art, including the Curtiss-Wright Models 23 and 21B airplanes, the Zien article, the Lachmann article, the Lombard article, the Zacher article, and N.A.C.A. Report Nos. 572, 703 and 713, all of which prior art aircraft and references are more pertinent than the references cited by the Patent Office. Pressteel Co. v. Halo Lighting Products, Inc., 314 F.2d 695 (9th Cir. 1963); Monroe Auto Equipment Company v. Superior Industries, Inc. 332 F.2d 473 (9th Cir. 1964); Henderson v. A.C. Spark Plug Division of General Motors Corp., 366 F.2d 389 (9th Cir. 1966) Groen v. General Foods Corporation, 402 F.2d 708 (9th Cir. 1968). The patentee is charged with full consequences of all prior knowledge or use by others. Everlube Corporation of America v. Electrofilm, Inc., 154 F.Supp. 788, 803 (D.C. Cal. 1957), option adopted on appeal, 265 F.2d 495 (9thCir. 1959); Condenser Corporation of America v. Micamold Radio Corp., 145 F.2d 878 (2d Cir. 1944); Bone v. Marion County, 251 U.S. 134, 40 S.Ct. 96, 64 L.Ed. 188 (1919).

/5/ 29. The initial findings of the trial court in the case of Maurice A.

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Garbell, Inc. v. Consolidated Vultee Aircraft Corp., 94 F.Supp. 843 (D.C.Cal.1950), have no force or effect upon

the disposition of these actions because of the ultimate dismissal of the complaint therein with prejudice. Electrical Fittings Corporation v. Thomas and Betts Co., 307 U.S. 241, 59 S.Ct. 860, 83 L.Ed. 1263 (1939); Harries v. Air King Products Co., 183 F.2d 158 (2nd Cir. 1950).

/6/ 30. The evidence shows, and the Court concludes, that defendants McDonnell Douglas Corporation and The Boeing Company were not parties or privies to the prior action against CVAC. Defendants McDonnell Douglas Corporation and The Boeing Company are not estopped to attack the validity of the patent in suit by any prior judgment of which this Court has been apprised. Boutell v. Volk, 449 F.2d 673, 678 (10th Cir. 1971); Hy-Lo Unit & Metal Products Company v. Remote Control Mfg. Co., Inc., 83 F.2d 345 (9th Cir. 1936). This Court considerd the initial findings of the trial court in the prior action against CVAC and they are not persuasive for the reason that defendants herein have presented far more evidence on the question of patent invalidity than was presented by defendant CVAC in the prior action. Mast, Foos' Co. v. Stover Mfg. Co., 177 U.S. 485, 488-489, 20 S.Ct. 708, 710, 44 L.Ed. 856 (1900).

/7/ 31. The Court concludes from the evidence presented that the patent in suit is invalid since it lacks novelty and utility under 35 U.S.C. sec. 101, that the purported invention was anticipated under 35 U.S.C. sec. 102, that the subject matter of the patent was obvious to one skilled in the art at the time of the alleged invention under 35 U.S. sec. 103, and that the teachings of the patent are insufficient and the claims ambiguous under 35 U.S.C. sec. 112.

/8/ 32. The Court concludes that the continued prosecution of these actions through trial was done in bad faith and makes the case an exceptional one warranting an award of attorneys' fees within the meaning of 35 U.S.C. sec. 285. Shingle Products Patents v. Gleason, 211 F.2d 437 (9th Cir. 1954); Talon, Inc. v. Union Slide Fastener, Inc., 266 F.2d 731 (9th Cir. 1959); Tidewater Patent Development Co., Inc. v. Kitchen, 371

F.2d 1004 (4th Cir.) cert. denied 389 U.S. 821, 88 S.Ct. 46, 19 L.Ed.2d 74 (1967); Monolith Portland Midwest Co. v. Kaiser Aluminum & Chemical Corp., 267 F.Supp. 726, modified 407 F.2d 288 (9th Cir. 1969); Kaehni v. Diffraction Co., Inc., 3241 F.Supp. 523 (D.C.Md.1972) aff'd 473 F.2d 908 (4th Cir. 1973); L.F. Strassheim Co. v. Gold Metal Folding Furniture, 477 F.2d 818 (7th Cir. 1973).

33. Any and all of the foregoing Conclusions of Law which may be deemed to constitute Findings of Fact are hereby adopted as Findings of Fact.

Let judgment be entered accordingly.

See Appendix on next page.

(In the reprint, this page is followed by the footnotes and "Appendix B". "Appendix A", which is a less than readily readable photocopy of the patent in suit, is reproduced in large type in a separate Appendix D to the Petition for Writ of Certiorari).

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end

FOOTNOTES

Footnote 1 (appearing at 385 F.Supp. 1, 9, and on page "Appendix A-17" of this reprint).

"See Appendix A" (Appendix D of this reprint).

Footnote 2 (appearing at 385 F.Supp. 1, 9, and on page "Appendix A-17" of this reprint).

Sec. 271. Infringement of patent.
(a) Except as otherwise provided in this title, whoever without authority makes, uses or sells any patented invention, within the United States during the term of the patent therefor, infringes the patent.
(b) Whoever actively induces infringement of a patent shall be liable as an infringer.
(c) Whoever sells a component of a patented machine, manufacture, combination or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use, shall be liable as a contributory infringer.
(d) No patent owner otherwise entitled to relief for infringement or contributory infringement of a patent shall be denied relief or deemed guilty of misuse or illegal extension of the patent right by reason of his having done one or more of the following: (1) derived revenue from acts which if performed by another without his consent would constitute contributory infringement of the patent; (2) licensed or authorized another to perform acts which if performed without his consent would constitute contributory infringement of the patent; (3) sought to enforce his patent rights against infringement or contributory infringement. July 19, 1952, c.950, sec. 1, 66 Stat. 811.

Footnote 3. (appearing at 385F.Supp. 1, 10, and on page "Appendix A-17" of this reprint).

Sec. 281. Remedy for infringement of patent.
A patentee shall have remedy by civil action for infringement of his patent. July 19, 1952, c.950, sec. 1, 66 Stat. 812.

Footnote 4. (appearing at 385 F.Supp. 1, 10, and on page "Appendix A-17" of this reprint).

28 Sec. 1338 JUDICIARY – PROCEDURE
Note 1

Sec. 1338. Patents, plant variety protection, copyrights, trade-marks, and unfair competition.

(a) The district courts shall have original jurisdiction of any civil action arising under any Act of Congress relating to patents, plant variety protection, copyrights and trade-marks. Such jurisdiction shall be exclusive of the courts of the states in patent, plant variety protection and copyright cases.
(b) The district courts shall have original jurisdiction of any civil action asserting a claim of unfair competition when joined with a substantial and related claim under the copyright, patent, plant variety protection or trade-mark laws.
As amended Dec. 24, 1970, Pub.L. 91-577, Title III, Sec. 143(b), 84 Stat. 1559.

Footnote 4a. (appearing at 385 F.Supp. 1, 10, and on page "Appendix A-18" of this reprint).

"See Appendix A" (appearing as Appendix D in this reprint, in a volume separate from the present volume of reprints of "Opinions Below").

Footnote 5. (appearing at 385 F. Supp. 1, 10, and on page "Appendix A-18" of this reprint).

"See Appendix B" (appearing on page "Appendix A-88" of this reprint).

Footnote 6. (appearing at 385 F.Supp. 1, 10, and on page "Appendix A-18" of this reprint).

Sec. 101. Inventions patentable

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title. July 19, 1952, c.950, sec. 1, 66 Stat. 797.

Footnote 7. (appearing at 385 F.Supp. 1, 10-11, and on page "Appendix A-18" of this reprint).

Sec. 102. Conditions for patentability; novelty and loss of right to patent

A person shall be entitled to a patent unless –

(a) The invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
(c) he has abandoned the invention, or
(d) the invention was first patented or caused to be patented by the applicant or

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Page 11

his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application filed more than twelve months before the filing of the application in the United States, or
(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or
(f) he did not himself invent the subject matter sought to be patented, or
(g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In

determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other. July 19, 1952, c.950, sec. 1, 66 Stat. 797.

Footnote 8. (appearing at 385 F.Supp 1, 11, and on page "Appendix A-18" of this reprint).

Sec. 103. Conditions for patentability; nonobvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made. July 19, 1952, c.950, sec.1, 66 Stat. 798.

Footnote 9. (appearing at 385 F.Supp. 1, 11, and on page "Appendix A-18" of this reprint).

Sec. 112. Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

An element in a claim for a combination may be

expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof. July 19, 1952, c.950, sec. 1, 66 Stat. 798.

Footnote 10. (appearing at 385 F.Supp. 1, 24-25, and on page "Appendix A-45" of this reprint).

(A reproduction of the so-called "Cronstedt patent, U.S. Patent No. 1,547,644, Figures 1 through 5 thereof, on a single sheet, shown on page "Appendix A-87" hereof)

Footnote 11. (appearing at 385 F.Supp. 1, 26, and on page "Appendix A-45" of this reprint; the content or meaning of footnote 11 is not identified at 385 F.Supp. 1, 26, but may perhaps refer to the depiction at 385 F.Supp. 1, 7, appearing on page "Appendix A-13" of the present reprint).

Footnote 12. (appearing at 385 F.Supp. 1, 39, and on page "Appendix A-70" of this reprint).

"Footnote 6 – See page 10."

Footnote 13. (appearing at 385 F.Supp. 1, 40, and on page "Appendix A-72" of this reprint).

"Footnote 7 – page 10."

Footnote 14. (appearing at 385 F.Supp. 1, 41, and on page "Appendix A-75" of this reprint).

"Footnote 7 – See page 10."

Footnote 15. (appearing at 385 FSupp. 1, 41, and on page "Appendix A-75" of this reprint).

"Footnote 8 – See page 11."

Footnote 16. (appearing at 385 F.Supp. 1, 42, and on page "Appendix A-77" of this reprint).

"Footnote 9 – See page 11."

July 28, 1925. 1,547,644

V. CRONSTEDT

AEROFOIL

Filed Oct. 31, 1921

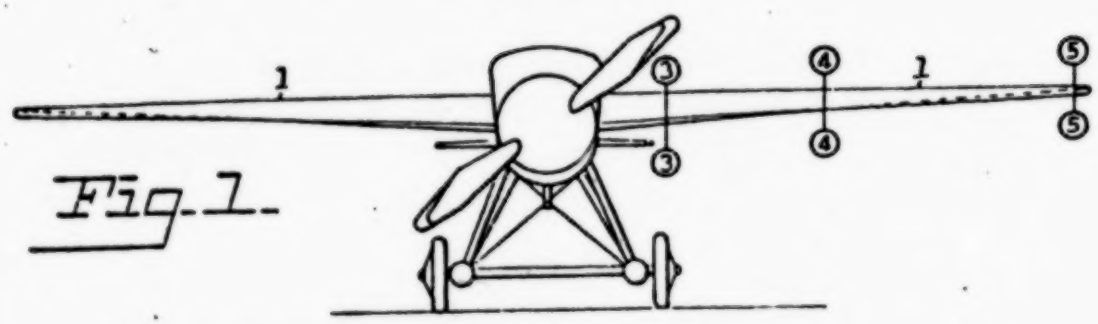

Fig. 1.

Fig. 3.

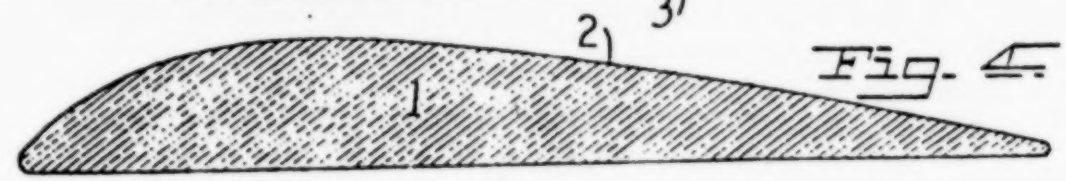

Fig. 4.

Fig. 5.

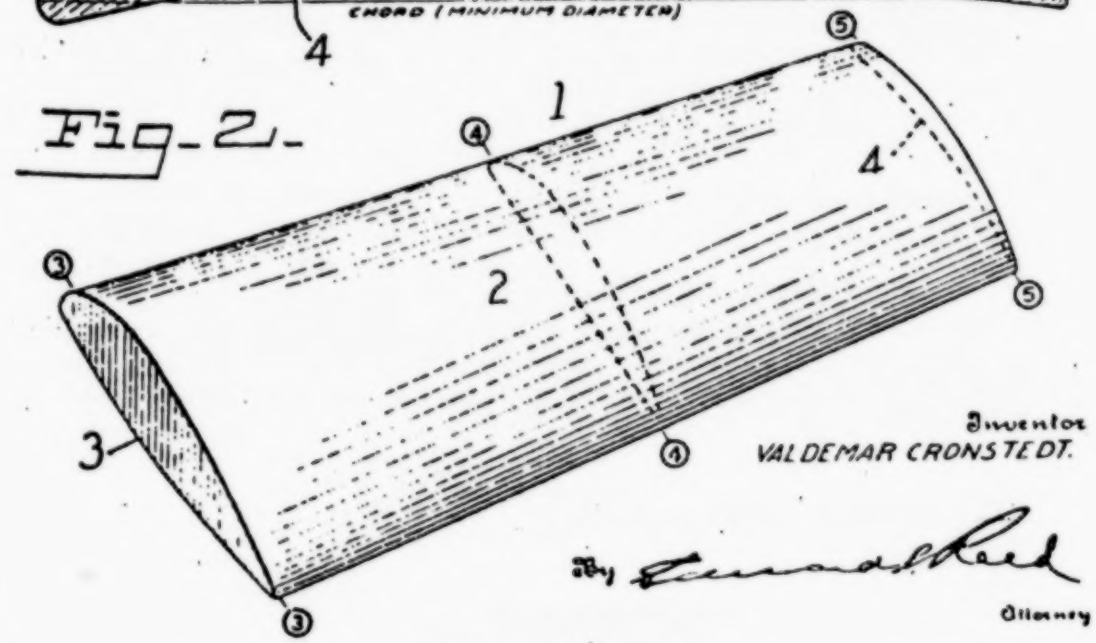

Fig. 2.

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APPENDIX B

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

MAURICE A. GARBELL, INC., et al.,
Plaintiffs,
v.

THE BOEING COMPANY, INC.,
Defendant.

Civil Action No. 63-658-AAH

MAURICE A. GARBELL, INC., et al.,
Plaintiffs,
v.

DOUGLAS AIRCRAFT COMPANY, INC.
Defendant.

Civil Action No. 63-659-AAH

ORDER

On Friday, May 14, 1971, plaintiffs' motion for continuance of the trial previously set for June 1, 1971, came on to be heard at 9:30 A.M. in the United States District Court for the Central District of California, 312 North Spring Street, Los Angeles, California, the Honorable A. Andrew Hauk, Judge, presiding.

Having reviewed all briefs, affidavits and documents pertaining to plaintiffs' motion for a continuance of the trial date, and related motions, and having heard all arguments of counsel pertaining to said motion, and good cause appearing therefor,

IT IS HEREBY ORDERED:

1. Plaintiffs' motion for continuance of the trial date from the previously set date of June 1, 1971, is denied:

2. Trial will commence on June 1, 1971, at 9:30 A.M., and the taking of evidence will be confined to the subject of patent invalidity or patent validity, and all defenses raised by defendants tending to show the invalidity of the patent in suit.

3. Plaintiffs will commence the trial by placing the patent in evidence, and if they wish, may then present additional testimony relating to the invention covered by the patent.

4. Defendants will then present evidence in support of the invalidity contentions and have the burden of going forward with the evidence on all issues of invalidity inclusive of the issue of reduction to practice, or lack of reduction to practice, with plaintiffs to present all evidence in opposition and rebuttal thereof, with rebuttal by defts. and surrebuttal by plaintiffs, if any, respectively they desire to present.

5. At the conclusion of the taking of evidence on all issues pertaining to patent validity and patent invalidity, the Court will set a date for final argument

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and due dates for the filing of post-trial briefs. At the final argument, each side will have one hour in which to present closing arguments.

6. Thereafter, the Court will announce its judgment. If, in the Court's judgment, the patent is invalid, the Court will hear arguments on the question of whether or not the Court should make the appropriate findings under Rule 54 of the Federal Rules of Civil Procedure requisite to entering a final judgment. If the Court's judgment is that the patent is valid, the Court thereupon will set a date for the resumption of the trial on the issues of patent infringment, or non-infringement in the actions.

IT IS SO ORDERED this 27th day of May, 1971.

/s/ A. Andrew Hauk
A. Andrew Hauk
UNITED STATES DISTRICT
JUDGE

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end

APPENDIX B

OPINION AND DECISION OF THE
COURT OF APPEALS FOR
THE NINTH CIRCUIT

Federal Reporter, Second Series,
Volume 546, Pages 297 through 301.

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MAURICE A. GARBELL, INC., a California Corporation, and Garbell Research Foundation, a California Non profit Corporation, Appellants,

v.

The BOEING COMPANY, a Delaware Corporation, Appellee.

MAURICE A. GARBELL, INC., a California Corporation, and Garbell Research Foundation, a California Non-profit Corporation, Appellants,

v.

McDONNELL DOUGLAS CORPORATION, Appellee.

No. 74-1017.

United States Court of Appeals,
Ninth Circuit.

Nov. 10, 1976.

Rehearing and Rehearing En Banc
Denied Dec. 28, 1976.

Assignees of patent covering a fluid foil lifting surface brought action for infringement. The District Court for the Central District of California, A. Andrew Hauk, J., 385 F.Supp. 1, entered judgment in favor of defendants and awarded attorney's fees and costs to defendants and assignees appealed. The Court of Appeals, Goodwin, Circuit Judge, held that evidence sustained findings that patent did not meet the tests of novelty and utility and was anticipated by prior art, that the invention had been on sale for more than one year prior to the date of the application, that the subject matter of the patent was obvious to one skilled in the art, and that teachings were insufficient and the claims were ambiguous; that award of attorney's fees was justified; and that award in the amount of $237,062.50

was not excessive in view of fact that the proceedings in the district court had taken ten years.

Affirmed.

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George B. White (argued), San Francisco, Cal., for appellants.

Richard B. Hoegh (argued), Hahn, Cazier, Thornton, Hoegh & Leff, Los Angeles, Cal., for appellees.

Before GOODWIN and SNEED, Circuit Judges, and EAST,* District Judge.

GOODWIN, Circuit Judge:

Maurice A. Garbell, Inc., and Garbell Research Foundation appeal an adverse judgment in this patent infringement suit against The Boeing Company and McDonnell Douglas Corporation claiming infringement of Claims 1, 2, 3, and 7 of the Garbell Patent No. 2,441,758.

The Garbell plaintiffs acquired the patent by assignment from the patentee, Dr. Maurice A. Garbell. After several years of discovery and an extended trial the defendants prevailed on all counts.[1] The court awarded attorney's fees of $237,062.50 to the defendants pursuant to 35 U.S.C. sec. 285.

I. Patent Validity

The patent in suit is entitled "Fluid Foil Lifting Surface," and concerns the shape of airplane wings. The district court held that this patent has almost every defect known to patent law: it did not meet the test of novelty and utility as required by 35 U.S.C. sec. 101;[2] it was anticipated by prior art and thus was invalid under 35 U.S.C. sec. 102(a);[3] the invention had been on sale and in public use more than one year prior to the date of the application for the patent as contemplated by 35

U.S.C. sec. 102(b);[4] the subject

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matter of the patent was obvious to one skilled in the art and thus the patent was invalid under 35 U.S.C. sec. 103;[5] and the teachings of the patent were insufficient and the claims ambiguous under 35 U.S.C. sec. 112.[6]

Dr. Garbell's wing design utilizes three airfoil sections. An airfoil section represents a cross section of the wing at vairous points along its width. One property of an airfoil section is it meanline camber. Dr. Garbell claims that his wing embodies a novel and unique relationship between the meanline cambers of the airfoil sections.[7] The Garbell wing design is said to reduce the danger of uncontrollable stalls in the aircraft.

The district court was not convinced that Garbell's design constituted a novel or unique approach to wing geometry. The court found, as noted, that the invention had been anticipated by prior art. For example, the Curtiss-Wright Co. built a series of planes which by 1940 included models CW-21(b) and CW-23. The issue of the geometry of the wings of these Curtiss-Wright models was referred to a Special Master. The finding of the Special Master (adopted by the district court) was that the geometry of the wings of the Curtiss-Wright planes embodied the same combination of elements as Claims 1, 2, 3, and 7 of the Garbell patent.

The court also found that the essence of the Garbell Wing had been published and was well known more than one year prior to his patent application. This knowledge was imparted through reports and publicaions by Garbell himself as well as by other aeronautical engineers and the National Advisory Committee on Aeronautics. Although no other wing description exactly duplicated the Garbell wing, the court found that a consideration of the totality of the prior publications would render the wing design obvious to a skilled member of the airframe industry.

Additionally, the court found that the Garbell Wing was on sale more than one year prior to the date of the patent application and that Garbell actively participated in those sales efforts. Finally, the court adopted a finding that the teachings of the patent did not give sufficient guidance to the public so as to avoid the necessity for extensive experimentation to make the patent operable.

/1/ In reaching its findings, the court relied upon evidence produced in lengthy proceedings which included the testimony of several expert witnesses and the interpretation of numerous scientific exhibits. Unless found to be clearly erroneous, the findings of the district court must be upheld. Fed.R.Civ.P.52(a); Tri-Tron International v. A. A. Velto, 525 F.2d 432 (9th Cir.1975); W. S. Shamban and Co. v. Commerce and Industry Insurance Co., 475 F.2d 34 (9th Cir. 1973).

/2/ After a review of the record in this case, we cannot say that these findings are clearly erroneous. Since the district court applied the correct law to the findings, we must affirm the judgment as to the invalidity of the patent.

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II. Attorney's Fees and Costs.

/3/ Under 35 U.S.C. sec. 285,[8] the district court may award reasonable attorney's fees to the prevailing party in "exceptional" patent cases. This award is within the discretion of the trial court. Appellate courts do not countermand that discretion unless it has been abused on the part of the trial judge. Purer & Co. v. Aktiebolaget Addo, 410 F.2d 871 (9th Cir.) cert. denied, 396 U.S. 834, 90 S.Ct. 90, 24 L.Ed.2d 84 (1969); Shingle Products Patents, Inc. v. Gleason, 211 F.2d 437, 441 (9th Cir. 1954).

/4/ The trial court's discretion in awarding attorney's fees in patent cases may be invoked only upon a finding of bad faith or unequitable conduct on the part of the losing party which would make it grossly unjust for the

prevailing party to be left with the burden of his litigation expenses. Purer & Co. v. AktiebolagetAddo, supra; Rohr Aircraft Corporation v. Rubber Teck, Inc., 266 F.2d 613, 624 (9th Cir. 1959); Park-In Theaters, Inc. v. Perkins, 190 F.2d 137, 142 (9th Cir. 1951).

In the case before us, the district court found that the conduct of the plaintiffs amounted to bad faith and that it "would be unconscionable to require the defendants to bear the burden of their defense cost." Maurice A. Garbell Inc. v. Boeing Co., 385 F.Supp. at 38 (Finding N17). Specifically, the court found that Garbell had misled the patent office by suppressing relevant evidence of prior publications, 385 F.Supp. at 38 (Findings N13-N15, N17), and that he did not make a reasonable assessment of the possibilities of infringement before bringing suit (Finding N16).[9]

/5,6/ The patent applicant owes a duty to the patent office to make a full and fair disclosure of all facts which may affect the patentability of his invention. Precision Instruments Manufacturing Co. v. Automotive Maintenance Machinery Co., 324 U.S. 806, 818, 65 S.Ct. 993, 89 L.Ed. 1381 (1945). A breach of that duty is relevant not only in determining the validity of the patent but also the good faith of the applicant in maintaining subsequent infringement actions. Monolith Portland Midwest Co. v. Kaiser Aluminum and Chemical Corp, 407 F.2d 288 (9th Cir. 1969); United States v. Barker, 514 F.2d 1077 (2d Cir. 1975).

/7/ While the district court noted that the conduct of the plaintiffs may not have amounted to fraud, it "was below the standards of good faith and candor required by inventors dealing with the Patent Office." Maurice A. Garbell Inc. v. Boeing Co., 385 F.Supp. at 38 (Fidning N15). This finding of bad faith is an adequate foundation for deciding that this case is exceptional within the meaning of 35 U.S.C. sec. 285. Monolith Portland Midwest Co. v. Kaiser Aluminum and Chemical Corp., supra; Shelco Inc. v. Dow Chemical Co., 466 F.2d 613 (7th Cir. 1972); Kahn v. Dynamics Corp. of America, 508 F.2d 939 (2d Cir. 1974); cert. denied, 421 U.S. 930, 95 S.Ct. 1657, 44 L.Ed.2d 88 (1975).

/8/ The additional finding that the patentee did not make a reasonable assessment of the possibilities of infringement before bringing suit lends further support to the conclusion that this case was "exceptional". Talon Inc. v. Union Slide Fastener, Inc., 266 F.2d 731 (9th Cir. 1959); Kaehni v. Diffraction Co.., 342 F.Supp. 523, 526 (D.C.,Md. 1972).

We have also noted that the record is replete with circumstantial evidence of intransigence and vexatious behavior by the plaintiffs which ran up the costs. The trial court's findings of bad faith are supported by the record and are not clearly erroneous. We agree with the trial court that this is an "exceptional" case which justifies the

award of attorney's fees under 35 U.S.C. sec. 285.

/9/ The award of $237,062.50 in attorney's fees is one of the largest reported awards under 35 U.S.C. sec. 285. However, in light of the extraordinary length of time (ten years) that was consumed by these proceedings and the necessarily great numer of hours expended on behalf of defendants by their counsel,[10] we cannot say that this award is excessive or unreasonable.

Appellants have sought to make a point of some of the colloquy on the part of the trial judge which indicated the strength of the judge's feelings about the antecedent behavior of some of the appellants. While the judge expressed himself forcefully, and perhaps thereby addedd unneeded fuel to the appellants' displeasure, we cannot say that the colloquy reveals bias or prejudice. The trial judge's somewhat scathing remarks were not surprising in light of the provocation, even though, upon more mature reflection, he might have delivered substantially the same message in softer language.

/10/ Finally, the award of costs to the defendants in the amount of $51,843.03 was also within the discretion

of the trial court and entirely proper. Fed.R.Civ.P.54(d); 28 U.S.C. sec. 821; 28 U.S.C. sec. 1920.

The judgment of the district court is affirmed in all respects.

FOOTNOTES

* (at 546 F.2d 297, 298, appearing at page "Appendix B2" of this reprint).

The Honorable William G. East, United States Court District Judge for the District of Oregon, sitting by designation.

1. (at 546 F.2d 297, 298, appearing at page "Appendix B-2" of this reprint).

Maurice A. Garbell Inc. v. Boeing Co., 385 F.Supp. 1 (C.D.Cal.1973).

2. (ibid.)

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

3. (ibid.)

"A person shall be entitled to a patent unless –(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for the patent * * *."

4. (at 546 F.2d. 297, 298, appearing at page "Appendix B-3" of this reprint).

"A person shall be entitled to a patent unless – * * * (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for the patent in the United States * * *."

5. (ibid.)

"A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains * * *."

6. (ibid.)

"The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is mostly nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention * * *."

7. (ibid.)

A more detailed description of the technical features of the proposed wing design and the state of the prior art is contained in the district

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court's opinion. Maurice A. Garbell Inc. v. Boeing Co., 385 F.Supp. 1 (C.D.Cal.1973).

8. (at 546 F.2d 297, 300, appearing at page "Appendix B-4" of this reprint).

"The court in exceptional cases may award reasonable attorney fees to the prevailing party"

9. (at 546 F.2d 297, 300, appearing at page "Appendix B-5" of this reprint).

Because we held that these findings adequately support the award of attorney's fees, we express no opinion on the alternate grounds relied upon by the district court.

10. (at 546 F.2d 297, 301, appearing at page "Appendix B-6" of this reprint).

These proceedings began in 1963 and took over ten years to complete, even excluding the time consumed by this appeal. The court found that counsel for the defendants reasonably expended 18,525 hours on this case.

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End

APPENDIX C

ORDER OF THE UNITED STATES COURT OF APPEALS FOR THE NINTH CIRCUIT

Filed December 28, 1976

Denying Petition for Rehearing.

(Marked: "Filed Dec 28 1976 Emil C. Melfi, Jr. Clerk, U.S. Court of Appeals")

UNITED STATES COURT OF APPEALS

FOR THE NINTH CIRCUIT

MAURICE A. GARBELL, INC., a California corporation, et al.,
Appellants,
v.
THE BOEING COMPANY, a Delaware corporation,
Appellee,

MAURICE A. GARBELL, INC., a California corporation, et al.,
Appellants,
v.
McDONNELL DOUGLAS CORPORATION,
Appellee.

No. 74-1017

ORDER

Appeal from the United States District Court
for the Central District of California

Before: GOODWIN and SNEED, Circuit Judges, and EAST,* District Judge.

The panel as constituted in the above-numbered case has voted to deny the petition for rehearing. Judges Goodwin and Sneed have voted to reject the suggestion for a rehearing en banc, and Judge East has recommended rejection of the suggestion for rehearing en banc.

The full court has been advised of the suggestion for en banc rehearing, and no judge of the court has requested a vote on the suggestion for rehearing en banc. Fed. R. App. P. 35(b).

The petition for rehearing is denied and the suggestion for a rehearing en banc is rejected.

*The Honorable William G. East, Senior United States District Judge for the District of Oregon, sitting by designation.

PROOF OF SERVICE.

I, George B. White, attorney for Maurice A. Garbell, Inc., and the Garbell Research Foundation, Petitioners herein, and a member of the Bar of the Supreme Court of the United States, hereby certify that, on the 13th day of April 1977, I served copies of the foregoing Appendices A, B, and C to the Petition for a Writ of Certiorari to the Supreme Court of the United States, as identified on the cover hereof, on the several parties thereto, as follows:

1. On The Boeing Company, Defendant, by mailing three copies in a duly addressed envelope, with first-class postage prepaid, to its attorneys,

PERKINS, COIE, STONE, OLSEN & WILLIAMS,
J. PAUL COIE,
1900 Washington Building,
Seattle, Washington, 98101.
(206) 682-8770

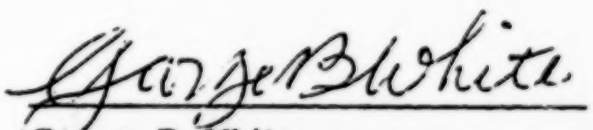
2. On the McDonnell-Douglas Corporation, Defendants, by mailing three copies in a duly addressed envelope, with first-class postage prepaid, to its attorneys,

LOUIS LIEBER, JR.,
WALTER J. JASON,
3000 Ocean Park Boulevard,
Santa Monica, California 90405.
(213) 399-9311, Extension 4275.

3. On The Boeing Company and the McDonnell-Douglas Corporation, Defendants, by mailing three copies in a duly addressed envelope, with first-class postage prepaid, to their attorneys,

HAHN, CAZIER, THORNTON, HOEGH & LEFF,
RICHARD B. HOEGH,
RUSSELL P. KUHN,
Crocker Citizens Plaza,
611 West Sixth Street, Fourteenth Floor,
Los Angeles, California 90017.
(213) 628-6151.

It is further certified that all parties required to be served have been served.



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